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Electricity in the Midlands.

IT is interesting to observe that year by year the City of Birmingham tends to grow in importance as a focus of engineering activities in general and of electrical engineering in particular. In addition to its highly esteemed University, its admirable Electricity Department, and the great electrical factories which have been established within its borders, it has afforded accommodation for the British Industries Fair, which next year will again break all previous records; other symptoms of activity are the Midland Engineers' Ball, a most popular function, the joint meetings of the engineering societies which are held there and have proved highly successful, and the annual dinner of the South Midlands Centre of the Institution of Electrical Engineers, which this year attracted no fewer than 320 members and guests.

Dr. Eccles, at the last-named function, described Birmingham as the Mecca of the engineering world, and reminded his audience of the epoch-making work of Boulton and Watt in laying there the foundations of the "industrial revolution" which transformed England into a manufacturing country; and to come back to the present day, the City has of late figured prominently in Parliament as one of the first non-standardised areas to be endowed with the blessings of a 50-cycle frequency—at a cost of some millions sterling and a certain (or uncertain) amount of disturbance during the process. Birmingham, however, has not shown much enthusiasm for the promised blessings, and perhaps that is the reason why Sir Philip Dawson on Friday last, ostensibly proposing "The Institution of Electrical Engineers," devoted five minutes of his speech to the subject of the toast and the other thirty minutes to the abounding virtues of the Electricity (Supply) Bill of which, since its early stages in the House of Commons (when he criticised some of its original provisions), he has become so zealous, so eloquent, and so confident an advocate.

We gathered from Sir Philip's extended remarks that he had thoroughly investigated the evidence on

which the proposals in the Bill were based, that he was satisfied of their soundness, and that all right-thinking people agreed with him. Unfortunately, the privilege which he apparently enjoyed has not been accorded to the electrical profession, which with a few exceptions remains in the dark as to the bases upon which the gigantic edifice of the Government scheme has been erected. Just two years ago, in the same hall and at the same function, in the presence of Sir John Snell, Mr. R. A. Chattock appealed to the Electricity Commissioners to hold a conference with the leaders of the electricity supply industry before deciding to take action on the lines which had been foreshadowed, and he has repeated that appeal more than once since then. He and other engineers have also pressed for the publication of the evidence—without success. We conclude, with a fair measure of certainty, that the witnesses were far from unanimous, although their names were set forth in the Weir Committee's Report without any qualification, as though they were all whole-hearted supporters of the scheme. From the start the dice have been loaded; not only has the detailed evidence been withheld, but statistics have been manipulated and facts distorted to make a case, and the most weighty protests have passed unheeded.

Mr. Chattock, addressing himself to the toast of "The Electrical Industry," justly remarked that Sir Philip had proved himself as great a Parliamentarian as an engineer; but he pointed out that in spite of the troublous times, the electricity supply industry was developing at an extraordinary rate—without the Electricity (Supply) Bill, which, as he said, found favour with very few supply engineers. With his advice to the industry, that it should concentrate attention on cheapening the cost of distribution, of wiring houses, and of electrical apparatus we cordially agree; but for the imposition of huge expenditure on the industry with only remote prospects of a return on the outlay we have no liking.

A Campaign Complaint.

In some of our references to the Campaign for expediting the wiring of the homes of Britain we have urged all sections of the industry to give their full co-operation. While, as our weekly record of progress shows, enthusiasm has been fairly widespread, there are spots where the temperature still lingers few degrees, if any, higher than Freezing Point. This description of the situation applies where there are handicaps which really need not exist and which can be removed by some enterprising individual or group of individuals applying a thawing-out process. In one of our articles we expressed a hope that nowhere would electricity suppliers and traders fail to rise to the occasion. Unfortunately, they have not risen everywhere yet, but there is still time for them to do so. Our post-bag has furnished particulars of areas where, though authority has existed for some time past for mains extension to give a badly-needed supply, no attempt has been made by the undertakers to lay the comparatively small lengths of cable necessary to give it. Residences waiting for this supply have been wired in readiness for months past, but even now there is no information forthcoming as to the date when it can be expected. Well may a correspondent refer to the adverse effect upon our present extensive popularisation movement when either through apathy or other inexcusable cause the would-be consuming public is left in an awkward fix and the efforts of the contractor to "get a move on" are discouraged. Without singling out areas at the moment, we would suggest that all electricity supply departments find out if the cap fits; if it does, let them, without saying anything about it, correct their faults. Of what avail is it for the industry to beat its big drum if, when the public gathers round for domestic electricity, it gets the impression that the electricity authority "doesn't want us!"

Municipal Trading.

In *The Times* of November 23rd there appeared a letter from Mr. W. G. Towler, secretary of the London Municipal Society and National Union of Ratepayers' Associations, commenting on the recent discussion in the House of Commons with regard to the merits of municipal and private enterprise, and suggesting that the municipal undertakings seek to establish a monopoly of electrical wiring and fitting, with disastrous consequences both to their consumers and to private traders. He adduces the tenders for an electrical installation at the L.C.C. Hackney Institute, reported in our issue of October 29th ("Contracts Closed"), in support of his theory, pointing out that the lowest of the eleven tenders was submitted by a private firm (£1,899), and the highest by the Electricity Department of the Borough of Hackney (£4,137).

How a local authority can secure a monopoly of work by quoting more than double the prices offered by four contractors (one of whom was successful) it is difficult to see; surely it is more likely to secure no work at all. As was shown in our issue of November 19th, p. 859, the Sale of Fittings clause now embodied in the Electricity (Supply) Bill includes provisions which render it impossible for the authority to carry out work except at prices which show a profit sufficient at least to cover interest and sinking fund on the capital outlay, and which fully safeguard the interests of the contractor in open competition with the authority. The wiring department of a municipal undertaking will have to be extremely well managed if it is to succeed in competing with contractors under the conditions laid down. On the other hand, it should have no difficulty in providing its consumers with that continual, prompt, and efficient maintenance service which is essential to the development of the industry, or in establishing hire-purchase and assisted-wiring schemes, such as have proved so strikingly successful where supply authorities have been able and willing to adopt them. Neither of these important functions has been or can be adequately fulfilled by contractors.

Mr. Towler also states that "Municipal undertakings can, and do, specify what sort of electrical fittings shall be used by householders." If they do, they break the law, which explicitly states that they have no jurisdiction beyond their supply terminals. A few undertakings have obtained statutory powers over-riding this law; so far as the others—the vast majority, including also the companies—are concerned, if they impose restrictions on consumers, Mr. Towler's associations ought to "call their bluff" and bring them to book.

The Artificial Silk Industry.

There are further signs of activity in the artificial silk industry, and several new factories are predicted. Scottish Artificial Silks, Ltd., a new company with a capital of £400,000 in 5s. shares, is to equip a spinning plant in the Old Providence Mill at Hyde in Cheshire and a manufacturing plant at Kirkcudbright. Courtaulds are intending to erect a new factory at Holywell, in North Wales, but it is reported that this project is temporarily held up. Wooltex, Ltd., is another new company to be formed for the purpose of producing the new so-called artificial wool.

Some opportunities for British electrical engineers should be available in the many new factories which are being erected abroad; in Japan especially activity is very great at the present time. Scandinavian countries have special chances of successful artificial silk production, but on account of the small home population and the highly-protective tariffs of other countries little progress has been made until recently, when both Norway and Sweden have become active in the matter. Greece, Rumania, Russia, and Turkey have all proposals on hand, and in some cases these are being actively proceeded with. It is, however, probably Australia and Canada where the greatest opportunities lie, and whilst Courtaulds have already a factory in the latter country, rumour is also associating their name with a big project in Australia.

Electrical Instrument Manufacture.

The Works of Messrs. Everett, Edgcumbe & Co., Ltd.

By the courtesy of Messrs. Everett, Edgcumbe & Co., Ltd., we were recently afforded the opportunity of a glimpse into the electrical-instrument industry as carried out at their Colindale Works at Hendon. It will, in the first place, be of interest to give some particulars of the history of this firm, which dates back to 1889, when Mr. James Swinburne, F.R.S., and Lord Russell founded the business, under the style of Swinburne & Co., with works at Broom Hall, Teddington. In 1894 the concern was absorbed by the Nalder and Harrison syndicate, of which Mr. Haydn T. Harrison was the technical partner. Mr. E. I. Everett founded a similar business in Charterhouse Square, London, in 1896, and in 1900 the two concerns were amalgamated and became Everett, Edgcumbe & Co. From that time progress was made which soon demanded larger premises. Works were established at Great Saffron Hill, and again in 1905 on the present site at Hendon, where two acres of land were acquired. A modern factory was equipped for the production, almost entirely, of all kinds of electrical instruments, and to this extensions have been continually made to the present day when the factory covers a floor area of some 35,000 sq. ft.

Fig. 1.—Machine Shop.

The Colindale works at present comprise three main buildings, accommodating the offices, machine shops, testing department and stores, and a number of smaller buildings which serve for such operations as brass founding, grinding, plating, enamelling and lacquering. The iron castings are received from an outside source, and are dealt with in these auxiliary buildings. One of these places also serves as a distributing centre for the power supply to the works, the supply being received from the Hendon Electric Supply Co. at 415 V 3-phase. Two motor-generators provide for the considerable d.c. requirements of the factory. Excluding these machines, about 100 h.p. of motors are installed throughout the works.

The factory proper is arranged so as to give a maximum of working room per operative, with adequate lighting and ventilation, and the various machines and assembly benches are so laid out to permit, as far as possible, the progressive manufacture of the instruments and their parts in defined directions, in accordance with modern production methods. Raw-material stores are situated on one side of the main machine and assembly room, while the other side accommodates the tool room and stores and the finished-part stores. A feature of the last-mentioned department is an excellent system of indicating the state of the stores. Every type of part is numbered and docketed, the dockets being housed in a convenient position on the wall. Red slips attached to any docket draw the attention of the progress department to that particular stock.

The machining operations are carried out in two distinct sections, the machine shop, fig. 1, where the actual instrument parts are turned, stamped, drilled and so on, and the tool room where the many ingenious tools required for the making of the various intricate parts are prepared. Among a number of the usual machine-shop equipments, such as lathes, drillers and stamping machines, may be seen a few specially designed machines. One of these is a gear-hobbing apparatus, which provides for the tooth-cutting of clock wheels and those employed in the gear drives of generator testing sets. The teeth are cut by means of a revolving worm running at right angles to and engaging with the part to be cut. Both of these elements are revolved synchronously, independent of the number of teeth required. Special machines employed in the blanking-out of disks and cutting and filing of dies are also of considerable interest and fascinating to watch in operation.

Fig. 2.—Assembly Room.

The assembly room, fig. 2, constitutes a continuation of the machine shop. The work is arranged in sections, and each of these is overlooked from an inspector's office. Every part has to be tested separately when it is assembled, and for this purpose a number of testing

transformers are placed on the benches at various positions throughout the department. These supply a testing pressure of 3,000 V, and are controlled by a foot-operated safety plunger switch. The metal covering of the bench constitutes one terminal (earth) of the testing circuit, a specially insulated portable connection serving as the other.

The fixed parts of the instruments are assembled in the cases in this branch of the works, where also the movements are built up, but these units are assembled in the test room, which will be referred to later. An interesting and novel system of winding for moving coils is to be seen here. The coil is wound in two sections on two separate formers, which are clamped together after assembly on the spindle. The advantage of this method of construction for the solid-core instrument will be seen. Another interesting feature is the assembly of instrument damping vanes. A shallow aluminium dish is puckered diagonally, and the supporting arm is inserted in the fold, by means of which it is securely held. This operation is effected by means of a small press tool, two diagonal sections of rubber providing for the pucker when it is put under pressure. Other features of this part of the works are the assembly of magnetos for electric speed indicators, portable transformers, various designs of "Superscale" instruments, and movements too numerous to describe in detail. The assembly of the very fine movements for the dwarf class of instruments is carried out in a room totally partitioned off; some of the coils used for this class of work are wound on formers of less than ½ in. maximum dimension.

Fig. 3.—Scaling Department.

The heavier machine work is done in a separate room which formed the original works at Colindale. Electrically-driven presses, guillotines, and so on are installed here. Probably the outstanding features of interest in the works, from the point of view of works management, are the research and development departments. The latter is a recent innovation of Messrs. Everett, Edgcumbe & Co., who have for a long time time felt the need of a link between the research and works departments. A number of productions which have been dealt with in the research department are sufficiently advanced to be of commercial value, but not to a sufficient extent to permit of standardisation, and it is for their further development during their commercial manufacture that the department has been established. At the time of our visit such parts as control springs were being dealt with here. A particularly interesting procedure is the making of pointers for the dwarf instruments. Wire is first rolled down through a series of rollers to fine strip, pieces of which are then treated on a swaging machine and reduced in thickness to within very fine limits. Finally the head and point are stamped out of the same metal to a thickness of only ten mils.

Apparatus for the inspection of the jewels and pivots is among the other interesting features of this department. The outline of the pivot point or of a lead impression of the jewel is projected on to a screen suitably arranged in a vertical case. The screen carries radial lines to enable the curvature of the pivot or the jewel to be gauged.

Some of the finer assembly work and adjustments, and the processes which are closely allied to the testing operations are done in an annexe to the testing department. It is interesting to note that the company prints its own charts for the recording instruments by means of a chart-printing apparatus installed in this department. The coil winding is also effected here, the wire being wound on cards. Very tiny motors, mounted on the benches, are employed for driving the winders. Dial scaling is also a feature of interest. During test the instrument scales are marked with the cardinal points. By means of a scaling instrument, which carries an extended arm swivelled at the scale centre, the points are projected on to an enlarged opal scale on which the divisions are easily sub-divided. These, by means of an ingenious pen-operating device, are projected back again to the small scale. This instrument is of the firm's own design. Fig. 3 shows the scaling department. It was interesting to note in passing that some of the larger instruments were marked on the scales with the shunt limits. This is to comply with the recent regulation of the British Engineering Standards Association, permitting the instrument-scale limits to be above those of the corresponding shunts. Fig. 4 shows a view of the test room, which is arranged in two sections, one for a.c. and one for d.c. This department is equipped with the usual testing devices arranged on suitable benches. An e.h.p. cubicle provides pressures up to 120 kV for testing work. A photometer room is provided for the adjustment of photometers made in the works. An equipment here for measuring heavy a.c. by means of standard shunts

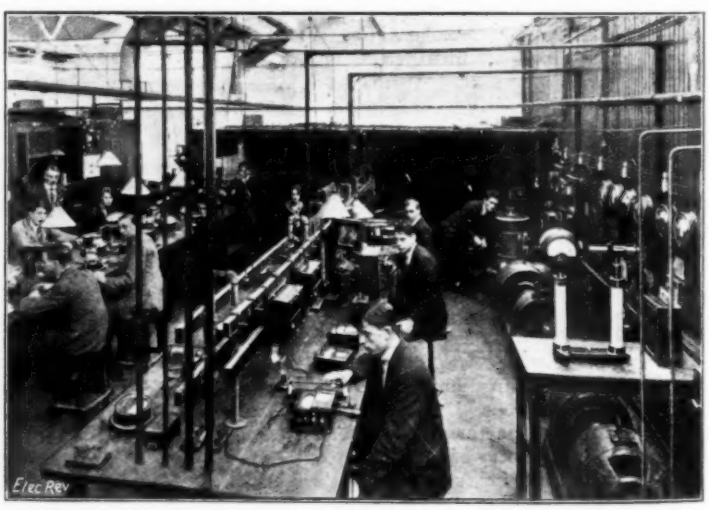


Fig. 4.—Test Room.

is of some interest. It is in a darkened section of the room, and the volt-drop across the terminals of a shunt is transformed up and reflected on a semi-circular scale, of about 10 ft. radius, situated near the ceiling. The stroboscope and tuning-fork method is used for frequency calibration. As already indicated, a separate department is devoted entirely to research. Among the uncommon instruments and apparatus to be found here is a Poulsen-arc machine used for developing high-frequency instruments, and very complete a.c. potentiometer equipment.

In conclusion, it is interesting to note that the output of the works has been more than doubled since the year 1921-1922.

Extra-High-Pressure Overhead Transmission Lines.

Adverse Conditions under which they Operate.

By A. T. S.

THE supplier and the user of electricity are alike interested in the provision of a continuous and reliable supply. Overhead-line transmission is particularly in evidence at present, owing to the widespread interest in a cheap supply, and therefore a simple review of the conditions under which such a supply must operate should be of general interest. That a supply by overhead lines can be reliable is not in doubt, and that such a supply is sufficiently reliable to meet commercial demands is proved by the rapidly-growing number of consumers supplied in this way. Nevertheless, interruptions of a supply by bare wires must be expected, especially where a duplicate circuit is not provided. The causes that may bring about an interruption of a supply are numerous and difficult to determine accurately, and owing to the distances and nature of the country passed over, observation is not easy. On this account, disinterested observers and passers-by are often able to assist materially the responsible parties by relating relevant observations.

A large proportion of transmission-line faults are of a transient nature, difficult, if not impossible, of location, and on this account give rise to conjecture, which, if based upon incomplete information, may lead to unfounded conclusions. All that may be known about a fault is that it is transient. On this account some inherent characteristic or weakness may be suspected when actually the fault is external. The issue may be further complicated by the fact that an inherent characteristic may only be troublesome when certain external conditions obtain. It is only the external conditions that will be here considered and with particular reference to high-voltage lines on pin-type insulators.

Climatic conditions in this country may be considered as more favourable than those in many places abroad, but it is the extreme conditions that have to be provided against, and it will be found that these conditions are quite severe.

The temperature to which a line is subjected varies from the maximum possible temperature in the sun at any time in any year down to the lowest temperature experienced at the maximum altitude of the line. Wind, snow, sleet, and rain have to be contended with in all the possible combinations and at various temperatures. These conditions do not necessarily affect the line throughout its length. A fairly long line may be subjected to very varying adverse conditions at one and the same time at different places throughout its length. Under all conditions the line must stand for a useful length of time, and the possibility of wires breaking, of the sag becoming ununiform or abnormal, or of any undue movement of the wires on their supports, or of the supports themselves, has to be guarded against. Perhaps the worst condition to be met in this respect is when ice, frozen snow, sleet, or frost adheres to the wires, so that the exposed area becomes many times that of the bare wires, and while in this condition they are subjected to a high wind or gale. The chances are that the lines are unequally loaded, both in neighbouring spans and between the several wires in one span, so that the sag of some wires is very different from that of the others. Unless such conditions have been provided for, a short circuit may result either from the reduced clearance of the still wires or from the asynchronous swing of the wires in a high wind.

The action of frost on line insulators is by no means beneficial. The atmosphere may be very humid at the time the frost sets in, and the whole surface of the insulator may be covered with a frozen film. This film will be cracked by the ordinary vibration of the line and when a thaw sets in, the cracks will be first of all filled with moisture, tending to form a local path for the leakage current right along the whole surface of the insulator. Under these and similar conditions, obviously the electrical design of the insulator is defeated and the flash-over value is lowered during the commencement of a thaw after the insulator has been covered with ice or frost. Fogs and heavy mists act in a similar manner where the moisture content is so high that the under portions of the insulator sheds can be covered with moisture.

High winds in themselves are not harmful to the safety of a well-designed line, but when solid particles are blown across a line at high velocity, a static charge may be set up in it. Such phenomenon is common and is liable to be experienced where lines run near the sea coast or in the vicinity of sand dunes. The impurity of the air in the neighbourhood of transmission lines is important, since this affects the surface conditions of the insulators, and may even be such as to affect the line wire, especially in strong sunlight. Although the impurities may be present in minute proportions only, their effect is continual and cumulative. Salt air, acid fumes and carbon or metalliferous particles are amongst the commoner impurities, while it is suggested that some gases given off by trees are detrimental. On account of these impurities it may be found necessary to clean the insulators on extra-high-voltage lines, and indeed in certain areas this is essential.

Where a transmission line passes over points of high altitude, not only must special consideration be given to the insulation and flashover properties of the insulators, but also the question of atmospheric potential may have to be considered. A dangerous potential may be caused by the line passing through differently-electrified strata of the atmosphere, or by the presence of electrified clouds at varying heights. Most of the above circumstances, if not all, can be guarded against, but when new districts are being traversed by overhead lines for the first time, local conditions may cause trouble with the higher voltages—say 20,000 volts and upwards—until these are fully understood.

In some districts birds cause a considerable number of failures of supplies, and in this connection local observation is useful. Rooks seem particularly fond of

sitting on crossarms, and by coming in contact with the line, cut off the supply. Other birds may congregate on a line, and in the late summer flocks of birds have been observed on one line wire with others underneath, and if any quarrelling goes on under these conditions a short between phases is not unlikely. Large birds and owls can also cause a short between phases. A flashover between lines has been stated to have occurred while a flock of birds flew across or through the line wires without any bird being observed to fall. The explanation given was that the speed of the birds' flight was too great to allow the shock to kill the bird that started the arc, but more probably the offending creature was carried some distance away by the impetus of its flight. A troublesome fault on a line was reported to be due to the excreta of birds.

On a well-cleared line route there is not much excuse for branches of trees or twigs touching the line wires while they are growing; nevertheless, such conditions have caused failures of supply. In a high wind, however, twigs and branches are liable to be hurled upwards on to the line wires, and it is still easier and more common for straws or hay to be blown against line wires, with very prejudicial effects on the supply. Other natural occurrences to be guarded against are lightning discharges—a source of danger which may be present at any time—but, fortunately, means are available which minimise the number of faults from this cause. Beyond the natural phenomena liable to cause line troubles, there must be mentioned other causes such as stone throwing at insulators, the use of shot guns, air guns and catapults in the vicinity of line insulators. The number of faults due to these causes is by no means negligible, and the boy with a kite has often caused a temporary cessation of the supply. In this connection a new form of tinsel wire has been used for kite-flying, with detrimental effects.

Where a transmission line runs on an embankment close to passing locomotives, it is conceivable that a combination of smoke, carbon particles and wet steam may surround the wires in such volume as to cause a flashover, and flashovers probably due to such conditions have been stated to have been observed by an engine driver.

Certain of the causes mentioned here may appear trivial, but experience tends to show that very trivial things may cause a flashover on a line to earth or between lines, and that each flashover constitutes a short on the system usually of a severe nature.

The Polarity of Current Transformers.

A Simple "Direction" Finder.

By G. E. MOORE, A.M.I.E.E.

CURRENT transformers which are used only for ammeters, some relays, and so forth need not be marked in any way for polarity; but those which are intended for general work (for instance, in an electrical test-room), and especially those which are installed with watt-meters and like instruments, should clearly show the polarity. In the notable case of metering electrical energy on a polyphase circuit where, when the installation work has been completed, verification tests are being carried out, the character of the load may cause perplexing results to be shown by the instruments; and here, especially, should the instrument transformers be accessible for inspection, assurance is greater. The clear and correct marking of polarity results in quicker and more reliable work.

"Polarity."

The term "polarity" refers to the actual direction of current flow in the secondary winding, as compared with the primary at any particular instant. The term,

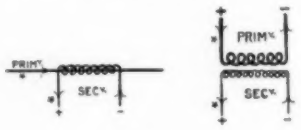


Fig. 1.

in a sense, is misleading, and it is more accurately stated as the *relative instantaneous polarity* of the windings. Fig. 1 gives a diagrammatic explanation: on the left a ring-type c.t., and on the right a 2-coil c.t.

It should be noted that the + primary terminal shows *incoming* current to the winding, *i.e.*, supply system on left and consumer on right; while the + secondary terminal shows current *leaving* the winding *en route* to the + or "feed" terminal of the current coil of the meter or like instrument. The said c.t. terminals are sometimes referred to as the "feed" or "*marked*" terminals, and a simple, plain indication on or adjacent to the terminals or "feed" side is preferable from the wireman's point of view and makes later verification when actually in position (and perhaps "alive") much easier. Arrows to show respective directions of current flow are liable to be misunderstood. Some current transformers, of course, are constructed for installation in switchgear or tanks in one possible position; others announce the polarity by coloration of leads. However the c.t. polarity *is* shown, it should be such as to ensure correct and ready connecting-up and, if possible, subsequent examination whilst "alive."

The B.E.S.A. Specification for Instrument Transformers (No. 81-1919) makes the following remarks with reference to the subject:—

Terminal Markings.

13. The terminals shall be distinguished by the following letters or signs indelibly marked on them. On a single-phase transformer the letter T shall be used. . . .

The same letters shall in all cases be used on the same phase in the primary and secondary, capital letters being employed to distinguish the primary, and capital letters with circles around them being used to distinguish the secondary.

Marking of Polarity.

14. The relative polarity of the two ends of every winding shall be shown by the addition of markings 0 and 1 after the phase letters. The terminal marked 1 shall be referred to as the positive end of the winding. The polarity of the corresponding primary and secondary windings shall be so marked that the direction of the electromotive force at any moment from T_0 towards T_1 is the same as from (T_0) towards (T_1). . . .

Testing for Polarity.

From the manner in which the one or more windings of a current transformer are made up it is, in the case of the maker, a simple and straightforward matter of routine to know the polarity facts; but, for the user, inspection of the average finished transformer affords no clue. Therefore, the user has recourse to testing—either to determine the directional facts or merely as a check on the manufacturer's marking.

In the event of a wattmeter or watthour-meter being tested with its current transformer(s), the correct connections for meter performance are determined and marked on the test-bench; but, while such guidance might suffice for the installation of the particular complete equipment, it would be possible for the current transformer(s) actually to be improperly marked for

direction and, if any kind of modification took place later, misleading effects might ensue. It is advisable, then, to examine current transformers as units.

When a current transformer is under test for ratio, phase angle, and other data, the particular method of test (say, when using wattmeters) will give the necessary clue if conditions are known. A convenient method in a meter test-room is to utilise any a.c. meter which is "up for test" on a bench where polarity conditions are assured: with the pressure coil excited quite a small primary current in most cases suffices to give enough secondary current to move the meter disk.

Another method, interesting because utilising the simple principle of induction, is suddenly to pass a direct current of known direction through a winding—the direction of the current induced in the other winding being shown by the initial "kick" of a d.c. voltmeter connected to it. With this method, however, care must be taken in several ways. The passage of a heavy current through a winding may not only damage a winding, but can actually leave the iron highly magnetised, when ratio and phase-angle characteristics may be changed from normal—this, perhaps, after the pass-out test. Again, the voltmeter could be seriously injured both mechanically and electrically, and this probably would not be detected at the time. However, use can be made of a small dry cell as the source of d.c.

A Simple "Direction Finder."

The writer has devised a simple instrument whereby the direction-relationship of the primary and secondary currents are readily shown. This instrument was, in the first instance, produced for use on a test-bench where occasionally current transformers were tested for ratio by means of a "shunt" method, no convenient means being at hand for polarity determination. The instrument, however, is useful in other circumstances, and it is thought that a description of it will not be without interest.

It originated from a consideration of the historic Oersted experiment, by which was demonstrated the effect that a current-carrying wire, lying in the magnetic meridian, had upon a pivoted magnetic needle: the needle turning at right angles in a direction depending upon whether it was placed above or below the wire, and upon the direction of current flow. In fig. 2, for example, such a needle placed upon a bus-bar with direct current flowing as shown, will have its north-seeking pole deflected to the west.

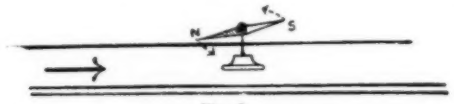


Fig. 2.

In the writer's "direction-finder" for current transformers the bus-bar or the like conductor of fig. 2 becomes the primary lead of a current-transformer circuit carrying a.c., while the magnetic needle is replaced by a pivoted iron core wound with insulated wire *and excited by current from the c.t. secondary.*

Fig. 3 is from a photograph of the original experimental device. The pivoted core is made up of short lengths of iron wire 2 in. long and is ¼ in. in diameter: on this are wound about 40 turns of enamel-insulated copper wire of 28 s.w.g., and the ends of the actual wire are formed into rough helical springs opposing each other and connected to a couple of terminals. The coil is pivoted to turn horizontally in a U-shaped support of brass mounted on a wooden base.

Under the influence of the primary field, the coil will turn to one side or the other, and this affords a clue as to the direction of secondary current flow relative to a "fixed" primary direction. As shown in fig. 3, the instrument is rendered more useful by suitable disposition of the terminals and leads; by affixing a special indicator to the moving coil; and by marking an arrow for primary direction.

The "direction finder" is placed upon a lead of the c.t. primary circuit; big arrow pointing to the transformer, and the latter's secondary winding connected to the terminals (*vide* fig. 4). When current flows, the moving coil leaves a position parallel to the big arrow (and primary conductor), and its "secondary feed" indicator will steadily point to whichever terminal is connected to the "feed" end of the secondary winding. (Fig. 3 shows it in such deflected position.)

On full load any standard c.t. will give 5 amps. in the secondary, but the thin wire of the coil need not be seriously heated as the required indication is at once

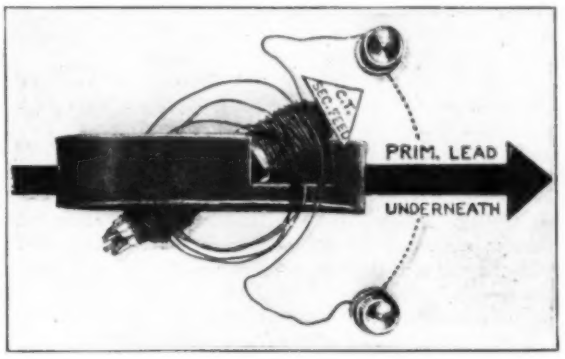


Fig. 3.

seen; owing, however, to the improvised helical springs, the coil will not deflect in the weak primary fields of low-ratio c.t.'s. A more robust instrument, suitably mounted in a glass-covered case with outside terminals, and having a coil with phosphor-bronze lead-in springs, has taken the place of the experimental direction-finder. It can be used for current transformers of the highest

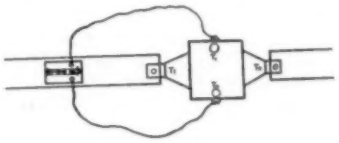


Fig. 4.

ratio-values down to 5/5 c.t.'s; with low ratios such as 10/5 the deflection with full-load amps. is small but evident, and can readily be increased by completing one or more turns around the instrument.

The direction-finder is useful on installed apparatus where, if possible, it is desired to verify connections and the like, and it will, of course, show the presence of a stray alternating field, if such exists and the coil can be suitably excited. It can be used in any position, but it will be understood that when the primary conductor lies across the upper side of the instrument, the indications are reversed.

Electrical Consumption of Farm Households.—The *Electrical World* quotes energy consumption data published by Miss Eloise Davison and analysed by the Home Economics Division of the Iowa State College, for different farm household appliances. Miss Davison says that although methods of manipulation, personal habits and individual abilities vary, the following table gives a fair idea of the energy consumptions under normal farmhouse conditions:—

AVERAGE ENERGY CONSUMPTION ON IOWA FARMS.

Device.	kWh per month. Per family.	Per person.
Electric range	102	25
Refrigerator	28-45	11-15
Ironing machine	2.8	0.46
Iron (used with it)	3	0.5
Electric cooker	5.5	0.9
Waffle iron	2	0.5
Washing machine	2	0.5
Percolator	6	1.5
Toaster	1.2	0.3
Glow heater	5	0.7
Water pumping (shallow)	795 gal. per kWh.	
Water pumping (deep)	576 gal. per kWh.	
Incubators	370 Wh per chicken (79 per cent. hatched).	
Water heater (60-70 deg. inlet, 128 deg. outlet)	4.5 gal. per kWh.	

Power Station Operation.

Some "Safety First" Suggestions.

By A SHIFT ENGINEER.

The advocates of "safety first" have been rather busy in ventilating their views recently in the technical Press, and an account of the recent fatality at the Rugby wireless station forces one to draw attention to the orthodox procedure of such inquiries.

It must be made clear that I hold no brief for any party concerned in this instance, and have no knowledge of the case other than that published in the Press. Those who have followed such inquiries will perhaps have noticed that the "dead man" has in most cases had to very conveniently shoulder the blame. Most supply undertaking men can draw instances from their own experience of where they have taken chances, perhaps have disconnected interlocking devices, and in doing so have got away with the job and have saved a shut-down or serious interference with the supply.

Those operating men who have encountered and overcome trouble on their shift know full well what thanks they get for doing these things. I speak of those who have had experience and do not try to defend the actions of those men who, when trouble crops up, immediately behave as if they were females in acute hysteria.

The trouble comes along; you do your best to cope with the circumstances that present themselves; you have not held rehearsals, everything being unexpected to a certain degree; and your report is written. When this is received at the office, the chief, comfortably seated in his arm-chair enjoying no doubt his favourite cigar, goes through the report in detail.

He picks out errors in operation which, in most cases, have occurred to yourself after everything is quiet and normal. If there has been an interruption of supply, what a song is made about the matter! Those who have risen above practical operation and those who have not been through the mill think little of the trials of the unfortunate operating man. To reduce the case to the ridiculous, put the critic on a plank over the damper bars in a hot furnace, where one sometimes has to go to remove an obstruction to the chain-grate, and fire a few pistol shots at him as one sees done in the wild-west comedies. Then will he be so cool, calm, and collected? which, one is told, must be the character of a good operator.

The chief dislikes shut-downs, so does the operator; but does he reflect how much more difficult the task is made, and how much his severe criticism affects the operator's confidence in himself at such times?

Such treatment has another effect, perverting the truth in trouble reports. Men who are censorious rarely get all the truth—and nothing but the truth—of these events.

I have known of cases wherein errors have resulted in interruptions which have been reported as being caused by feeder or network "shorts." The mains department has then spent days of fruitless search for non-existent trouble. Who is to blame is best decided by the individual.

Other questions that I dare not answer are: Do all undertakings comply to the letter with the regulations; and, is money ever stinted where a few pounds could remove a lot of danger? Much help is given by plainly designating switches and machines, either by numerals or by distinguishing colours. I believe that one large company at one time used rubber rings for placing over the switches and plugs on d.c. switchboards of the grid-iron type to suitably distinguish the switches to be opened or closed in complicated switching operations. Cubicle-type switchboards, with the ghosts of past unfortunates lurking around, naturally fill one with dread of the danger of the situation and the need for care.

Some interlocks are in themselves dangerous, and this brings to mind my first job, where the replacement of some cubicle gates needed, by reason of the interlocks, the display of some ingenuity. I got flustered over the attempt, and "all but" earthed the main 11,000-V busbars.

This again reminds me of the sight of a particularly saucy apprentice being unmercifully thrashed by his mate. The thrashing was well deserved, as the boy, entrusted with the manipulation of a draw wire through some lighting conduit behind an e.h.p. switchboard, had allowed the end to enter the expanded metal guard of an e.h.p. cubicle, and when discovered it was only 6 in. from a bare conductor!

Interlocked draw-out switchgear tends, in the mind of the experienced engineer, to be depended on to a too great extent. Who, after isolating an e.h.p. truck-type panel successfully, has not thought of the consequences had the main switch not been open? No attention had been given to this point, and the gear had been trusted implicitly to perform its work.

When d.c. switches may have to be operated whilst carrying heavy currents, some danger is removed by the provision of a rope or strap, with a loop at one end placed over the switch handle, with which to open the switch by pulling on the rope.

The advice of an old stager to me after I once made a mess of things, has something to be said for it. "Never try to do the job quicker or better than your mates." When the breakers come out, fuses blow, and machines flash over, leave everything to the automatic protective gear for a full minute while you light a cigarette. Trust protective devices above your own ability.

Operators in remote sub-stations, when earthing feeders, rely on another man at the other end for safety. Provision to enable them to determine for themselves the state of the apparatus is only fair. Should this be inconvenient to arrange, the responsibility for one man's safety could very well be taken by two men equally responsible.

When accidents occur, much injustice is often done to an innocent party by a "dead man's" mistake; there is always a disturbing cloud of doubt hanging over the one responsible for the order given. This is a point in favour of dual responsibility, one giving and the other checking the order given. Telephone messages should always be repeated where operations are so directed, and where life is at stake, written orders are preferable.

A message that never should be given is as follows: "The apparatus is safe to work on at a given time."

Consideration of the possibilities of such foolishness with a little imagination will provide the raw material for a week of nightmares.

The danger of oil circuit breakers of low capacity on circuits of high power is far too prevalent, and is not yet fully dealt with by Government regulations. Remote mechanical control is advisable in such cases for the sake of safety alone.

On older gear, isolating switches are situated in enclosed cubicles, and accidents have occurred through insulators breaking or cement working loose, allowing the blades of the isolators to remain closed. For this reason it is very desirable to be able to view the actual point of disconnection, when about to operate e.h.p. apparatus. Lever operation of isolating switches is a great help to safety.

Indicators on switches where mechanism is enclosed should form a positive indication of the switch position. Where red lamps are used to indicate the closed, green lamps must also be provided to show off position.

Another very fruitful possibility of accident results from painting the cubicle numbers on the remov-

able doors only. When they are removed for cleaning, the wrong doors may be placed on a given cubicle, and the operator may later go to the isolator chamber, isolate the feeder, and then go to work in a live cubicle.

Where e.h.p. work involves divided responsibility, hurry is best avoided if possible, and although but one operation be assigned to an operator, the whole of the work should be explained to him so that many checks of the procedure can be obtained. This must, however, not interfere with authority or discipline. These statements may raise some criticism, but it is thought that easy and safe working can be improved by compliance with such rules. Among operators, uniform switching procedure should be strictly adhered to. I have felt sure on more than one occasion that mistakes have been avoided by routine working in times of heavy stress.

Continuity of supply is, with some people, a fetish. Cases will occur when shift engineers have to take the responsibility in their own hands and clear some of the load. As a general rule, this action is left too late by reason of the personal consequences, and in nearly every case the engineer concerned has to shoulder the burden.

In some undertakings each trouble brings out a new order. Municipal concerns are especially liable to this comment, and, in most cases, one countermands the other; so when there is business in the air, the operator does not know where to turn. Why worry? He will get it "in the neck" either way!

The list of rules should be strictly limited to a few well thought out, to direct the general procedure in routine operations. Keep strictly, as far as possible, to these rules, and pick men suitable for their positions. Those who have made a mess of other firms' plant are generally best, due to the sobering influence of such affairs. Rules cannot be formulated to cover every possibility; give the utmost credit to the men engaged in what is sometimes a very trying task. This will prevent accidents resulting from men taking risks to cover up trifling personal errors by cutting out their purpose at the root.

Tradesmen effecting repairs are far too often left alone near e.h.p. gear. The position is rather difficult where old hands are concerned, who will not be told and are often trusted to look after themselves in places of danger. The most satisfactory method is to place an authorised person in charge of repairs, these being carried out under his supervision.

Work in isolator chambers is essentially dangerous, and can be made safer by providing impregnated wooden shutters, with slides to receive them, in order to prevent contact with live metal.

D.c. panels have sometimes to be worked on, and when circuit breakers are attended to alive, asbestos partitions should be provided and attached on either side of the circuit breaker under repair; earthed metal fixing nuts should be covered up, thus avoiding danger from burns from the opening of neighbouring circuit breakers on fault. Danger of shock can also be eliminated by standing on an insulating stool. Where d.c. circuits are isolated, the switch blades should be removed or wooden blocks, suitably lettered, placed over the fixed contacts of the switches.

On boards where plugs are used as busbar selectors, their removal should not be depended upon for isolating purposes, unless wooden plugs are inserted in their stead. Reliance for safety should not be placed on the switchboard instruments, as a blown fuse or sticking pointer may have serious consequences.

E.h.p. cubicles can, with some arrangements, be made alive from the l.p. side of the potential transformers. Earthing all conductors to be worked on and removing the l.p. potential fuses will obviate danger from this cause. The locking of switches also helps to remove danger when isolating. In the case of remotely-controlled switchgear, d.c. supply links or fuses can be removed during this operation, or at times when danger will result from the switches closing on their own. Although I have not known a switch to close, due to a control circuit fault, I have experienced faulty tripping from the same cause, and the two operations are similar. Care must be taken to see that the controller is in the off-position when replacing such fuses. A lamp is advisable where control circuits are supplied to each panel *via* fuses, as protection devices can be put out of order due to the failure of the latter. The state of the insulation of control circuits needs to be closely watched.

The use of the above precautions must not be indiscriminate, for as with danger notices, &c., used too freely, they defeat their object and fail to impress the operator with the importance of his action.

To the normally careful and experienced man, shock is the lesser danger, and severe electrical burns comprise, on large systems, by far the major portion of the accidents, fatal or otherwise.

Switchgear factories in their normal testing procedure leave much to be desired. In certain cases electrical tests at high voltages are performed by untrained men and youths not really suited to take responsibility.

In conclusion, let every precaution for safety be simple and straightforward, so that it does not take up the main attention to the neglect of the main danger. Let them also be reasonable, so that elaborate precautions do not tend to be neglected in entirety when stress of circumstances calls for rapid movement and quick thinking.

Fuses in Radio Circuits.

A Logical Means of Protection.

By PAUL D. TYERS.

In almost every branch of electrical engineering the fuse is considered a *sine qua non*. Strangely enough, however, the fuse seems to be almost entirely absent from wireless receivers.

A fuse can be used in a wireless receiver for three purposes: for protecting the valve filaments, for protecting the high-voltage battery, and for protecting the filament accumulator. Several attempts to market valve-filament fuses have been made, but do not seem to have met with much success, due, no doubt, to the fact that the public is rather reluctant to pay for any component which does not appear to produce an immediate increase in the efficiency of the receiver. The wireless enthusiast argues that with careful handling the possibility of the accidental burning-out of a valve is somewhat remote, and he therefore thinks twice before spending money on the purchase of fuses and also time to fix them in each filament circuit. Again, the wide dissimilarity of valve-filament characteristics makes the marketing of valve fuses exceedingly difficult, as a very great variety is required. Probably the "Barreter," or some form of constant-current limiter, would give the best results.

High-voltage fuses seem to be few and far between, but in the writer's opinion they are much more important than a valve fuse, since a stray high-pressure lead may result in the burning-out of a whole row of valves. In this connection it may be mentioned that several protecting devices have been marketed, such, for example, as the "Dubrescon." A high-pressure fuse, if properly designed, not only protects the filament against being accidentally burned out, but also greatly preserves the life of the high-pressure battery, since an accidental short circuit would immediately isolate it.

A little logical reasoning, however, seems to convince one that a fuse in the filament circuit is of vital importance, not so much with a view to protecting the valves, or any other part of the apparatus, as to guard against accidental short-circuits, which might set fire to the accumulator leads, and even the set and the building in which it is situated. In what other branch of electrical engineering would one install any apparatus in which a current of the order of 100 amperes is available without introducing a fuse, or some other form of protecting device? A freshly charged 6-volt 40-ampere-hour accumulator, for example, is capable of delivering a current

of very considerable magnitude for an appreciable period. The cause of fires which have originated in wireless sets has been traced, it is believed, in the majority of cases, to the filament circuit having become short-circuited, resulting in the leads becoming red hot, or even fusing, and the rubber and braid catching fire. All possibility of such a happening can be very easily eliminated by the introduction of something of the nature of a 5-ampere fuse of the cartridge type, connected directly to one of the accumulator terminals. A short-circuit between the two terminals is then almost impossible, and any defect arising beyond the fuse would cause it automatically to "blow," thereby safeguarding not only the set and its associated wiring, but also the accumulator.

Naturally, the trader does not want to alarm the public by suggesting possible fire risks, but, after all, it is only logical to fit fuses.

Copper for Electrical Purposes.

Some Interesting Data.

By T. G.

In spite of the universal use of copper as a conductor of electricity, the variation in the properties of the several grades of the metal available appears to be seldom realised. This is surprising, for the matter is of such outstanding importance that considerable sums may often be saved, simply by making sure that the most suitable grade for the work in hand is used.

It is probable that the biggest savings—in the form of lower losses as well as in smaller capital outlay—may be effected in the administration of the smaller organisations, where the engineer responsible has a multitude of other details to engage his time. Even so, however, it is well worth while to spend a little time and trouble over the copper specifications.

The purest copper obtainable is electrolytic copper. The material used for electrical purposes—practically all electrolytic copper—must reach a certain specified percentage of purity, for the presence of even slight traces of foreign elements has a very adverse effect upon the conductivity. It may be divided into hard-drawn and annealed copper. Both are manufactured by electrolytic methods, and the purity of the commercial product is usually well over 99.9 per cent. Before copper wire may be considered to be satisfactorily annealed, it must pass the following tests, carried out on a sample 10 in. in length:—

.0076 inch diam. and under, 15% min. elongation without fracture.

.0076 to .02 inch diam., 20% elongation without fracture.

Over .02 inch diam., 30% min. elongation without fracture.

Hard-drawn copper is generally used for such purposes as overhead power lines and telephone and telegraph work. The reason for its preference for these particular classes of service is to be found in its superior mechanical properties shown in the following table:—

Tensile Strength of Hard-drawn and Annealed Copper Wires.

Diam. in inches.	Breaking load in tons. Hard drawn.	Annealed.
.065	.098	.057
.080	.147	.086
.092	.194	.114
.104	.250	.140
.134	.366	.233
.165	.594	.354

These figures, which correspond to from 22 to 30 tons per sq. in. ultimate tensile strength for the hard-drawn material, and some 14 to 20 tons per sq. in. for annealed copper, indicate definitely that for purposes where high tensile strength is a primary requirement, only hard-drawn copper can be considered.

When we come to study the relative conductivities of the two materials we find the difference equally pronounced, but this time in favour of the annealed product. This is inevitable, for an increased resistance is always an accompanying phenomenon of the drawing operation. It has, indeed, been strongly contended that the two bear a definite mathematical relationship to each other.

The resistance of hard-drawn copper is usually from 2 to 3 per cent. higher than that of the annealed material, and it is obviously desirable in all cases where high tensile strength is not a definite requirement, that the latter material should be used. It is worth remembering that 2 per cent. higher resistance means 2 per cent. greater heating losses and 2 per cent. bigger "drop." A diminution in losses of this degree would mean a considerable saving of money to many firms!

This effect of drawing upon the conductivity of the material may be conveniently studied with the aid of the following figures culled from the specifications of the American Society for Testing Materials:—

Annealed copper, 98.2% conductivity.

Medium hard-drawn, above .325 inch diam., 97.7% conductivity.

Medium hard-drawn, below .325 inch diam., 96.7% conductivity.

Hard-drawn, above .325 inch diam., 97.2% conductivity.

Hard-drawn, below .325 inch diam., 96.2% conductivity.

The variation is dependent on the number of drawings, annealings, and similar factors, and it indicates very definitely the effect of this hardening operation.

Thus, it is quite clear that the two copper products have distinct properties which are appreciably different. To employ either under adverse conditions, where it is practicable to use the other, is not only bad engineering, but bad economics.

Legal.

Bogus Traveller Sentenced.

THE *Birmingham Post* reports that consecutive sentences of six months' hard labour in each of two cases of false pretences were passed upon Frederick Norris, an electrician, of no fixed residence, but formerly of Burton-on-Trent, by the Burton County Bench on November 23rd. Prisoner (who pleaded guilty) obtained 5s. from Emily Welch, of Tatenhill, on the representation that he was travelling for the Wireless Distributing Company, of Birmingham, undertaking to charge her wireless accumulators for 10s., payable in three months, but 5s. down. He was paid the 5s. and nothing more was heard of him, nor was there any such address in Birmingham as the prisoner gave. In a second case he obtained 10s. from Jane C. Ritchie, of Rolleston, saying that he was an inspector from the Post Office and required to see her wireless licence. The wireless set had only just been installed, and as the prosecutrix had not got her licence, he said he would get one for her and post it. Previous convictions were proved.

Colliery Firm Charged.

WE reported recently the death of a man named Brynmor John from shock received from coming into contact with an electrified fence with which the firm of Cory Bros. had surrounded part of its property. On November 20th the firm and three of its officials were charged at Bridgend (Glam.) with the offences of placing a "man trap" and manslaughter. A verdict of manslaughter against the persons responsible for the erection of the fence was returned at the inquest upon John. A month's adjournment was applied for and granted.

Theft of Electricity.

AT the Kingston Borough Police Court, on November 22nd, Herbert Thomas Mead, of Kingston, was summoned for obtaining electricity by fraud and for damaging a prepayment meter, the property of the Kingston Council. According to a *Yorkshire Post* report, when the meter at defendant's premises was examined, the seals were missing and there was no money in the box, although the indicator showed that there should have been 10s. The defendant said that he was endeavouring to press a shilling into the slot when the light came on and the indicator went round to "ten." He denied having tampered with the meter. He was fined £2 for obtaining electricity by fraud, but the charge of tampering with the meter was dismissed on payment of £2 2s. costs.

Electrical Goods Obtained by False Pretences.

CHARGED at Rawtenstall, on November 24th, with obtaining electrical appliances from Mr. E. B. Lord, Waterfoot, and an electric bowl-fire from Messrs. Leicester & Holt, Haslingden, by false pretences, Irving Fell, mill engineer, Cloughfold, was committed for six months, in each case, the sentences to run concurrently.

British Thomson-Houston Litigation.

MR. TREVOR WATSON moved before Mr. Justice Eve in the Chancery Division, on November 24th, for judgment in default of appearance and defence in the action the British Thomson-Houston Co., Ltd., *versus* Louis. Counsel said there were two patents involved in the case, and both had been held valid. The plaintiffs were joint registered legal owners of one of the patents with the Marconi Company. The particular invention in question was useful, both for wireless valves and electric lamps, and the Marconi Company and the B.T.-H. Company had joint interests, the former being interested so far as wireless valves were concerned and the B.T.-H. Company being interested so far as regarded its lamps.

His Lordship gave judgment as asked.

Deaths Caused by Decomposed Bitumen Cable.

IN the Court of Session, Edinburgh, on November 24th, Lord Moncrieff was informed of the settlement of the actions against the Coatbridge and Airdrie Electric Supply Company, Coatbridge, at the instance of an ironworker and his son and daughter, in which plaintiffs claimed damages for personal injury caused through carbon monoxide poisoning. The father also sued for compensation for the deaths of his sons from the same cause. Three of the company's electric cables passed near the residence of the plaintiffs. The father and child were sick one night in March last, and in the morning two of the sons were found dead in bed. It was averred that the bituminous insulation of the cables near the house had broken down, causing electric arcs to form, which decomposed the bitumen, giving rise to noxious gases in the wooden trough. These gases permeated the rooms of the house. The plaintiffs accepted a total payment of £425 with expenses in each action.

Alleged Motor Repair Frauds.

Two men, Anthony G. Clinton and Wilson Glossop, were last week committed for trial by the Sheffield magistrates for alleged frauds on a number of local tradesmen. It was stated by the prosecution that the men made a practice of visiting firms, and after certain inquiries, cutting the power line from the meter to the firm's motor. When the owner prepared next to use the motor he found that it was not in order, thereupon the defendants visited the premises and volunteered their services to repair the motor. In some cases, it was alleged, they represented themselves as being employed by the Corporation Electricity Department, and conveyed the motor away, returning it the next morning. In this way the defendants were said to have obtained various sums of money for "repairs." A Corporation electrician said that he examined the motors, and in none of them had anything more been done than to re-varnish the outside of the coils.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Smoke Abatement Bill.—During the Committee stage of the Public Health (Smoke Abatement) Bill, Lt.-Commr. ASTBURY moved an amendment to exclude from the expression "smoke," "soot, ash, grit and gritty particles." He said that certain manufacturers, rather than break the law, might be compelled to close down if the amendment were not carried.

Sir K. WOOD, the Parliamentary Secretary to the Ministry of Health, said it was a serious weakness of the present law that they were unable to deal with ash grit and gritty particles. The Ministry of Health had taken a good deal of pains to look into the matter of powdered fuel, and there was no apprehension that if proper steps were taken, any nuisance would, in fact, follow. Already some 14 towns were working under local Acts, which actually included in the definition of "smoke," grit and gritty particles. Those towns included Birmingham, Bolton, Morley, and Bradford, and no difficulties had arisen. In Birmingham no prosecution whatever had taken place.

Mr. H. WILLIAMS asked whether that was because of the complete failure of the Birmingham Corporation itself to eliminate grit from its electricity stations?

Sir K. WOOD said that the Birmingham Corporation, in connection with its electricity works, used a good deal of coal slack, and it had successfully adopted a particular process, and there was no trouble whatever.

The amendment was negatived by 23 votes to 5.

The Bill passed through committee without serious amendment.

Rugby Wireless Station.—On November 22nd, Viscount WOLMER informed Mr. Ammon that the cost of the Rugby wireless station, including the site, buildings and plant, was about £480,000.

South African Beam Stations.—On November 23rd, Sir W. MITCHELL-THOMSON informed Sir H. Brittain that the beam stations for communication with South Africa were practically completed, and preliminary tests had been carried out by the contractors. The tests indicated that the use of shorter wave-lengths than those for which the stations were originally designed would probably give a better and more continuous service, and the aerials were accordingly being adjusted to enable those shorter wave-lengths to be employed. The contractors anticipated that the necessary alterations could be effected in about seven weeks. Tests under the new conditions would then be necessary before the service could be opened to the public.

Emergency Regulations Rescinded.—On November 24th, Mr. RAINE asked the Secretary for Mines whether, in view of the improved outlook in the coal industry, it was not possible to relax the Coal Emergency Directions.

Colonel LANE-FOX said that it was, in his opinion, to the best interests of the country to relax those restrictions at the earliest possible moment, even at some risk. Although, therefore, supplies were still far short of the normal demand, output was steadily increasing, and he thought that the time had come when practically all the restrictions, except that which prohibited the export of coal, ought to be withdrawn, and freedom restored both to consumers and to the trade. The restrictions on the use of gas and electricity for lighting, heating, and power, and on the use and acquisition of coal by industries and businesses would be withdrawn as from the following day; the restrictions on the domestic consumer would continue only to the end of that week. As from that day, also, collieries would be given freedom to dispose of their coal as they pleased in this country, subject to their fulfilling any allocations made upon them by the District Committees. He regretted that the situation did not yet justify removing the prohibition on export, but as from Monday, November 29th, shipments would be permitted freely to Northern Ireland and the Irish Free State.

Officers' Electricity Charges. — On November 24th, Brig.-Gen. CHARTERIS asked the Secretary for War whether he was aware that army officers in Government quarters at Woolwich were being charged 6d. per kWh for electricity for lighting, power, and heat by the Government, which was itself purchasing the power at 2¼d. per kWh from the Woolwich Borough Council under a contract providing for the supply at 6d. per kWh for the first 165,000 kWh and 1d. per kWh thereafter during the year, with a minimum charge of 2¼d. per kWh for the whole supply for each year; that until recently officers paid only 2¼d. per kWh; that the new scale had been made retrospective to September, 1925; and what was the reason for the change.

Sir L. WORTHINGTON EVANS said that officers in Government quarters at Woolwich, who obtained electricity on repayment, were now charged 6d. per kWh for light, but only 2.9d. for power, and 1d. for heating, if supplies for those purposes were metered separately. The rates were those paid by the general public. The decision that preferential rates should no longer be given was promulgated at the end of July, 1925.

Special Orders.—On November 24th, the House of Lords approved of Special Electricity Orders relating to Barton and Urmston; Brecon; Avon Valley; Ryburn Valley and District; Salcombe and Kingsbridge; Uphill; Yarmouth; Whitchurch, Ellesmere and District; Herne Bay and District; Nantwich; Dingwall and District; and Maidstone.

The Institution of Electrical Engineers.

Annual Dinner of the South-Midland Centre.

THE annual dinner of the South-Midland Centre of the Institution of Electrical Engineers was held at the Grand Hotel, Birmingham, on Friday, November 26th. Col. J. F. Lister, C.M.G., T.D., M.I.E.E., presided, and a large and representative company attended, numbering some 320 members and guests.

Sir PHILIP DAWSON, M.P., proposed "The Institution of Electrical Engineers." There was no section of the country, he said, where the electrical industry had made greater progress than in the Midlands. In its development the members of the Institution had played a most important and useful part. No institution had made more progress than the Institution of Electrical Engineers, and its members were proud of its achievements. It was not only in scientific research that their members had achieved such world-wide reputation, but it was even perhaps still more in the field of its applica-

tion to production that they had achieved so much, and in this field, as well as in that of scientific research, they need not fear comparison with any country in the world. Wherever their products were employed they had gained the highest approbation for their quality and reliability. Their plant and machinery, their cables, their scientific instruments, had justly attained a reputation in the world's markets second to none. But when they came to consider the position of this country as regarded the general use and distribution of electricity they found they lagged behind most other industrial countries of the world. Dr. Eccles had pointed out in his presidential address that it was only by centralisation and interconnection that the cost of producing electricity could be reduced. He (Sir Philip) considered that there were four general conditions which must be complied with to secure the desired result:—(1) The centralisation, as far as possible, of production in well-located and efficient stations, and the gradual shutting-down of all inefficient ones; (2) the interlinking by means of extra-high-voltage overhead lines of the producing stations. This would result in each station having a larger output, a better load factor requiring less reserve plant, and a higher thermal efficiency; (3) the connecting-up to a general supply system of all auxiliary sources of power, such as waste heat, and water power; and (4) the separation of generation and transmission, which should be carried out on a national basis, from distribution, which must be regional, and which required special local knowledge. To enable centralisation and interconnection of supply to be effectively carried out, standardisation of frequency was essential. Once the electricity supply authorities realised that co-operation must be achieved he believed no difficulties would be encountered in carrying out such proposals. It was not suggested that the price of energy in industrial areas would be enormously reduced. Unquestionably it would be brought down, but in other areas where to-day the cost was prohibitive, or where there was no supply at all, a great demand would be created, all of which would benefit the electrical industry and create a demand for skilled electrical engineers.

Dr. W. H. ECCLES, responding, spoke of the wonderful progress which had been made in the development of electricity in the lifetime of many of those present, and of the enormous extent to which we had come to rely upon electricity. In the future we should rely upon it more and more, for electrical applications were growing rapidly. Electrical engineering was having a great effect upon the centre of England, both in the industrial area and the large agricultural area which surrounded it. In both these directions they of the South-Midland Centre would have the privilege of watching this electrical development in a way which most other centres would miss. In respect of agriculture the possibilities were enormous.

Mr. R. A. CHATTOCK submitted "The Electrical Industry." That industry, he said, had been for many years a growing industry and had now reached a very substantial position in this and in all other countries. Enormous development was going on in the supply industry in this country. In spite of the industrial troubles through which we had been, it had been developing in a very extraordinary way. Ten years ago the annual increase in the number of consumers in Birmingham was 1,000; at the present time they were puting on 10,000 consumers per annum. He did not think that justified the criticisms that had been levelled against the supply undertakings. It might be that they had not progressed so fast as in some other countries where conditions were different, but they were going ahead now. They were building up enormous businesses, and at a very great rate. Very few supply engineers liked the Electricity Bill, but now it was through they had got to make the best of it, and at the same time look after the interests of their consumers. Whatever scheme might be adopted he hoped it would not mean scrapping some millions of pounds' worth of plant. His advice to the industry was that they should concentrate upon cheapening the cost of distribution, the cost of the wiring of houses, and the cost of heating and cooking apparatus.

Mr. H. C. LEVIS, who responded, said this country was behind some other countries, and it would continue to be so until the industry was allowed to follow the natural laws of development, and until the workmen realised that more work meant more wages, more wages meant a greater purchasing power, and that that meant more comfort. There was no reason why the performance of America could not be duplicated here if we were allowed to do it.

Mr. G. VERITY gave the toast of "The City of Birmingham and Electricity Supply." Birmingham was universally acknowledged, he said, to be the great industrial metropolis of the British Empire. Its Electric Supply Department was one of the largest, most successful, and best run of the trading concerns of the country.

The LORD MAYOR, in reply, paid tribute to the manner in which the trading undertakings of the city, especially the Electric Supply Department, had carried on and delivered the goods under most adverse conditions during the coal strike. He expressed the city's indebtedness to the manager of the undertaking, the chairman of the Committee, and all those associated with them for their very honourable discharge of the obligations devolving upon them.

Col. J. F. LISTER submitted "Kindred Societies and Guests," and the toast was acknowledged by the Bishop of Birmingham.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. *No letter can be published unless we have the writer's name and address in our possession.*

The I.E.E. Presidential Address.

I attended the inaugural meeting of the 1926-27 session of the Institution of Electrical Engineers on October 21st, and listened with amazement to the address of Dr. W. H. Eccles. Immediately the meeting was over I made a protest to him against comparing our country with water-power countries in order to make disparaging comparisons with affairs at home.

A few days later, as I anticipated, the address was used in the Press in support of the Bill; I thereupon wrote a letter, of which the following is a copy, to the Secretary of the Institution:—

October 27th, 1926.

"Dear Sir,—I should be glad if you would put the following before the Council:—

(*a*) In view of the fact that in the presidential address last week matters of a highly controversial character were dealt with;

(*b*) In view of the undesirable results at home and abroad which may well ensue to our electrical trade and reputation through complaints by the President of an important organisation regarding our alleged "backwardness" in electrical power matters; and

(*c*) In view of the fact that this address has already been quoted in the Press, and it will in all probability be used as an argument on the political platform and to promote that very policy in Parliament about which the Council of the Institution, as such, sent a dignified protest to the Prime Minister earlier in the year——

I must ask, as a Corporate Member, that a special meeting be called at an early date to give an opportunity to members to discuss a number of the points raised in the address, so that when or if it is printed in the *Transactions*, details of any discussion can be given at the same time, as, otherwise, through the world-wide circulation of the text, the impression may be given that the views expressed are those acceptable to the Institution as a whole

I admit that it is almost without precedent for a presidential address to be discussed or even questioned, but I think it also unprecedented that a president, who can hardly claim to be an expert on the subject in question, at a most critical juncture in the electrical power affairs of our country, at a time when the Overseas Premiers are with us, during organised industrial unrest, by his address should even unwittingly be forwarding a policy, the only possible excuse for which must imply a failure, if not incompetence, in the stewardship of those engineers and others who have been put in charge of important public services, namely, the power supply of the country.

The address in question will encourage those bureaucratic and other wirepullers who must have advised the Prime Minister to put into the waste-paper basket a protest from the Council of the largest engineering and scientific body in the world.

I would not raise this question in this manner if I did not know that there are others with the same views as myself.—Yours sincerely,

(Signed) THEODORE RICH."

Before I received a reply the address was used extensively in the last-minute speech on November 12th (see *Hansard*, Cols. 1508-9-10) of the Attorney-General, who described Dr. Eccles's speech as "not by one who is not an expert, but by the present President of the Institution of Electrical Engineers," &c., &c. After a further letter to the Institution from me, pointing out that the address was being used as political ammunition, I received a reply on November 19th as follows:—

"Dear Sir,—I placed before the Council, at a meeting held yesterday, your letters of the 27th October and 13th November and I was instructed to say that the Council is unable to accede to your request, as to do so would be contrary to the well-established practice of the Institution not to discuss the inaugural address of a president.—I am, dear Sir, yours faithfully,

P. F. ROWELL, *Secretary*."

Despite the fact that the address was calculated to destroy the protest of the Council of the Institution to the Prime Minister, of March last, and despite its repeated use in Press and Parliament, no disclaimer was sent to the Press by Dr. Eccles to the effect that the address was not to be taken as being the accepted views of the Institution, or that his speciality was wireless, or that it was contrary to his wishes that it should be used for political purposes. After the ingenious use that was made of the address in the House of Commons, Sir Philip Dawson mentioned it again in the *Morning Post* of the 10th and 19th of November; the same arguments were brought up again on Tuesday last in the House of Lords with great effect by Viscount Peel, on behalf of the Government.

It is remarkable that a president of the Institution at such an important juncture should come forward with an address which fitted into the Government propaganda like a wheel in a clock, and which proved such a godsend in both Houses of Parliament.

I have no space here to deal with the address itself, its specious arguments and deductions, or its patent incongruities, but I have very little doubt that some of Dr. Eccles's views will be quoted with joy by the commercial travellers of some of our foreign competitors.

It is true that the address contains one or two disclaimers, but they bear no weight when compared with the mass of alleged comparable evidence brought forward on the other side. There is little doubt that the address will be "dished up" again at the third reading of the Bill in the Lords, should anyone have the temerity to question the necessity for, or the basis of, this wonder-working measure.

Theodore Rich.

Woldingham, *November 25th*, 1926.

Electricity Supply in Liverpool.

Distasteful as it is to take notice of anonymous correspondence in the Press, I must, for the sake of accuracy, refer to the letter that appeared in your issue of November 19th over the initials "N.H."

"N.H." has misquoted me both as to statements and figures, and it is apparent that he is not conversant with all the phases of the subject he has written about.

In conclusion, the schemes for alternative sites were thoroughly investigated, and the whole of the reports and figures were placed before the Electricity Commissioners, who sanctioned the extension at Lister Drive.

P. J. Robinson.

Electric Supply Department, Liverpool.
November 22nd, 1926.

Variable-speed Three-phase Motors.

In reference to "Variable Speed's" letter in your issue of the 26th inst., commutator motors, provided that they have shunt characteristics, with brush shifting gear, are suitable in every way for driving fans and compressors, and have been used extensively for this purpose.

If "Variable Speed" requires to run the fan at 2,000 r.p.m., a belt drive would be most appropriate, as the normal maximum speed for a three-phase commutator motor developing 40 h.p. would be in the neighbourhood of 1,000 r.p.m. The standard speed variation of such machines by brush shifting is 3 : 1, which is beyond the limits required by him.

As these motors develop constant torque the horse-power is directly proportional to the speed, whereas with a fan the power required to drive it falls off at a much greater rate.

Such motors have been applied to much more difficult cases than that of driving fans with great success by the Swedish General Electric, Ltd., and I do not think this firm would hesitate to give appropriate guarantees to deal with the conditions indicated by "Variable Speed" in his letter.

E. E. Tasker.

Brentwood, *November 27th*, 1926.

It is not surprising to find that fan makers do not recommend the use of three-phase commutator motors with brush-shifting gear, as this is thoroughly characteristic of the attitude of manufacturers in this country. Having specialised in the study of these motors, I would like to point out to "Variable Speed" that, not only are they perfectly reliable, but they possess quite remarkable qualities and are eminently suitable for fan driving. The advantages are: Perfect and absolutely smooth speed regulation; no losses on standing; high efficiency and unity power-factor over a wide range of speeds; a leading power-factor, if required, can be obtained for raising the average power-factor of the remainder of the plant.

Commutation, in well-designed modern motors of this type, is very nearly perfect, and absolutely perfect when the motor is running in the neighbourhood of synchronism. Such motors can, moreover, be run both above and below synchronism, and, consequently, by so designing them that synchronism occurs for the average required speed, good commutation is ensured over a wide range of speeds.

The idea that speed regulation can only be obtained by brush-shifting is quite erroneous; there are many other methods in use.

"Variable Speed" will find that a three-phase commutator motor will prove a far better proposition than any system of expanding pulleys, quite apart from considerations of increased efficiency and reduced floor-space. These motors are made for any ratings up to 800 h.p., and can be direct connected to high-pressure mains. They are started by merely closing a circuit-breaker. For the particular rating and speed range mentioned, motors of this type are in everyday use on the Continent.

C. W. O.

November 27th, 1926.

Power Supply of Wireless Sets.

With reference to the article "The Power Supply of Wireless Sets" in the current issue of the ELECTRICAL REVIEW, I think Mr. Irwin has failed to take into consideration a serious item in the use of h.t. accumulators—that of depreciation. In the hands of an experienced person no doubt these would have a useful life, but in the hands of the ordinary listener I am afraid this is not so.

I am responsible for the charging of a large number of wireless accumulators, and my experience of the manner in which the average listener treats his accumulator is somewhat painful; it seems impossible to make him understand that practically all his battery troubles are due to his own neglect.

I have h.t. batteries brought to me for charging where, not only are individual cells run down, but the polarity is reversed owing to the discharge being continued after these cells have become inert.

In the l.t. accumulator the worst that can be done is to run the battery *nearly* out, for when one cell fails the set usually ceases to function; but with the h.t. this is not the case, and reversal can, and does, take place, the result being rapid depreciation. Of course, this is not the fault of the accumulator; but the owner has his own opinion on this matter.

From personal experience I think the small Leclanché cells are much more suitable and cheaper for the ordinary listener. For my own use I fitted a 70-volt set of these cells in August, 1925 (50s. retail). To-day the voltage is 64, the greater portion of this drop taking place in the first two months of its life.

The cells are working on from two to four valves, and are in use for at least seven hours daily, and have received no attention of any kind except for a periodic checking of the e.m.f.

I anticipate a life of considerably over two years for this battery.

H. Hewlett.

London, *November 23rd*, 1926.

Electric Trucks for Brickyards.

We note with interest an article on page 883 of your November 26th issue on "Electricity in Brickyards."

You state: "The operations carried out in this company's many yards involve the transportation of clay for considerable distances from the pits to the works, and again in the conveyance of the bricks from the presses to the kilns. These operations are carried out largely by electric locomotives hauling trucks. . . ."

This paragraph gives the idea that the bricks are taken from the presses to the kiln by locos. This is not done, however, at all of the London Brick Co.'s works. In several the bricks are taken from the presses to the kilns by means of electric elevating trucks of our manufacture, and we may mention that within the last year or so we have supplied nine trucks for this work and have a further two in hand.

We enclose a circular which describes this particular development of the elevating truck, and would say that a considerable number of brickmakers are now using our machines to their great benefit.

Electromobile, Ltd.
C. G. CONRADI, *Managing Director.*

Otley, *November 26th*, 1926.

Scrapping Old Plant: Would it Pay?

In a works are three 220-volt d.c. generators, all driven by one steam engine through very heavy shafting, by ropes and belt. Each generator is on separate load:—

No. 1 generator 200 kW, reading 800 amperes.
No. 2 generator 100 kW, reading 230 amperes.
No. 3 generator 80 kW, reading 250 amperes.

1,280 amperes.

The indicated horse-power on the steam engine with the above load was 556 h.p.

The problem is: Would it pay to scrap all the three generators and put all the load on one 300-kW generator, of high efficiency? The present three generators are nearly 20 years old.

It would also be possible to run only half the heavy shafting.

Perhaps someone with more experience in this branch of electrical engineering would be good enough to give a help to

Works Electrician.

November 26th, 1926.

A Clearing House for Information.—As a result of successful conferences which have been held annually for the past three years, the Association of Special Libraries and Information Bureaux has been formed, and is now in process of incorporation. The Council cordially invites the support of all organisations and bodies, commercial houses, industrial concerns, &c., which attach adequate importance to the collection, treatment, and dissemination of information relevant to their work. The new body will act as a channel through which any inquiring member may be put into direct touch with the source of information required. With the generous assistance of the Carnegie Trust, it has in preparation a directory of sources of specialised information in the British Isles; a copy of this will be sent free to each member as soon as available. Membership is open to all interested bodies, and a small subscription of £2 2s. per annum has been fixed. Further details can be obtained from the Secretary, 38, Bloomsbury Square, London, W.C.1.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.—The official report for the week ended November 27th states that additional circles were formed at the following places:—Dumfries, Stourbridge, Wednesbury, Chesterfield, Loughborough, Exeter, Great Yarmouth, Felixstowe, and Ashford. Another demonstration house was opened at Birmingham (Hall Green), and similar premises were also inaugurated at Leeds, Halifax, Dewsbury, Batley, and Heckmondwike. An electrical exhibition was held at Ilkley. The attendance at the Dundee demonstration house is reported to be satisfactory, and during the first 16 days of its career the Edinburgh electric home was visited by 17,145 people. The builder has sold the house, and the furniture firm has sold the furniture and much more. Intensive local advertising is to be carried on in the spring. It is expected that a circle will be formed in Falkirk, and an exhibition is being planned for next year. An electrical exhibition is being held at Greenock at the end of the month; 100 new customers have adopted the assisted wiring scheme. Dumfries is also to hold an exhibition next year. Over 5,000 people visited the Paisley demonstration house, and it is proposed to run another. Electric homes are in prospect in Harrogate and Nottingham. Two have been arranged in the latter city, and were to be opened this week. The Leeds demonstration house was opened by Alderman Foster, chairman of the Electricity Committee, who was introduced by Mr. Nelson Hefford; Mr. W. B. Woodhouse (Yorkshire Electric Power Co.) was present. A window of one of the largest stores in Liverpool has been placed at the disposal of the local circle for a campaign display. Contractors are urged to make use of the campaign lantern slide for kinema advertising.

The Dewsbury Corporation's all-electric house was opened on November 26th by the Mayor (Alderman J. E. Kilburn), who is chairman of the Electricity Committee; he was accompanied by Major H. C. Frazer, of the Electrical Distribution of Yorkshire, Ltd., with whom the Corporation and the local electrical contractors are co-operating in the scheme. The Batley Corporation opened a house the same day. In this case, too, the Corporation is working in conjunction with the above company and the local contractors.

A leaflet has been produced by the British Thomson-Houston Co., Ltd., for the assistance of competitors in the ballot. This gives photographic reproductions of actual fittings corresponding to the outline sketches in the competition booklet. Prices and illustrations of about a hundred fittings are given, as well as a list of "Mazda" lamps. The leaflet has a space in which contractors' names may be printed.

The Shropshire, Worcestershire, and Staffordshire Electric Power Co. is very active in connection with the campaign.

A Shropshire, &c., Power Co. Display.

In conjunction with the electrical contractors in its area, it is holding a series of small demonstrative exhibitions of lighting and labour-saving devices throughout the towns and villages which it supplies. The local Press is being fully utilised, at least a dozen papers receiving advertisements. The accompanying picture is typical of the displays which the company is arranging.

At a recent meeting of the Aberdeen Electricity Committee it was decided to take over a new house in Hammerfield Avenue for the purpose of exhibiting to the public the latest developments in electric lighting. The house will be fitted up with all the most up-to-date designs in lamps and standards, and will, it is expected, be open for inspection by the public in the course of a week or two. The municipal wiring scheme instituted by the Committee, in co-operation with the local electrical contractors, a few months ago, has resulted in a marked increase in the number of installations, particularly in the middle-class residential districts.

In our last issue we illustrated the electric demonstration home at Erdington, arranged by the Birmingham Corporation Electric Supply Department and local contractors. We now reproduce another photograph of the house showing the effective way in which it is flood-lighted at night.

South American Electric Co.—As reported in our last issue, a company bearing this title has been formed, with headquarters in Zurich, for the main purpose of financing public utilities, principally in South America. The syndicate which formed the company is headed by Messrs. C. J. Brupbacher & Co., of Zurich, and is made up by the group of the Compañia Italo-Argentina de Electricidad, Buenos Aires, the Motor-Columbus Soc. An. d'Entreprises Electriques, Baden, Brown, Boveri & Co., Baden, the General Finance Company, Zurich, the Swiss Investment Company, Zurich, Messrs. C. J. Brupbacher & Co., Zurich, A. Hofmann & Co., Zurich, Pictet & Co., and Hentsch & Co., Geneva, and A. Sarasin & Co., Basle. The board of directors includes Mr. Richard T. Durran and Sir Bernard E. Greenwell.

We learn that the company is to acquire from the Buenos Aires Great Southern Railway Co. the electricity and gas works in Bahia Blanca, and the tramway system in that city, and also to acquire control of the undertaking of the Compania Americana de Luz, of Asuncion.

The Buenos Aires Subways.—The November *Review* of the Bank of London and South America says:—After numerous sessions held throughout the month, the (Buenos Aires) Municipal Council has come to a unanimous decision in respect of the much debated question as to whether or not the subway concession granted to the Anglo-Argentine Tramway Co. should be declared to have lapsed. The three proposals before the Council were all rejected by majority votes, and a resolution was adopted, in accordance with which the situation of the company will be regularised, the plans for the second subway being approved by the Council, and the company being required to present, within a period of 180 days from the date of notification, plans for the construction of the third subway.

For Sale.—Bath City Electricity Department has for disposal six generating sets, four water-tube boilers, underfeed stokers, &c. (See our advertisement pages to-day.)

Hackney Employés and the General Strike.—At last week's meeting of the Hackney Borough Council, Councillor Goodrich moved that a committee should be appointed to investigate the claims to reinstatement of certain men who were not taken back by the Electricity Department after the general strike. An amendment was moved approving the action of the Emergency and Electricity Committees in refusing to reinstate the men, and this was passed and carried as a substantive motion.

The Erdington Demonstration Home at Night.

An Anglo-German Conference.—It is announced that a conference will take place this week-end between representatives of the Federation of British Industries and the German Federation of Industry. The object of the meeting is to discuss what steps can be taken for the promotion of the mutual interests of the industries of Great Britain and Germany. According to the *Financial Times* the following will take part in the conference:—Dr. Duisberg (president of the Reichsverband), Herr Frowen (deputy-president), Herr Kastl, Dr. Herle, Sir Max Muspratt, Bt. (president of the F.B.I.), Sir Eric Geddes, Col. F. V. Willey, Col. O. C. Armstrong, D.S.O., Sir Vincent Caillard, and Sir Peter Rylands.

Lead.—Messrs. James Forster & Co. reported on November 27th that supplies still exceeded the demand, and as long as this continued no sustained advance in prices could be expected.

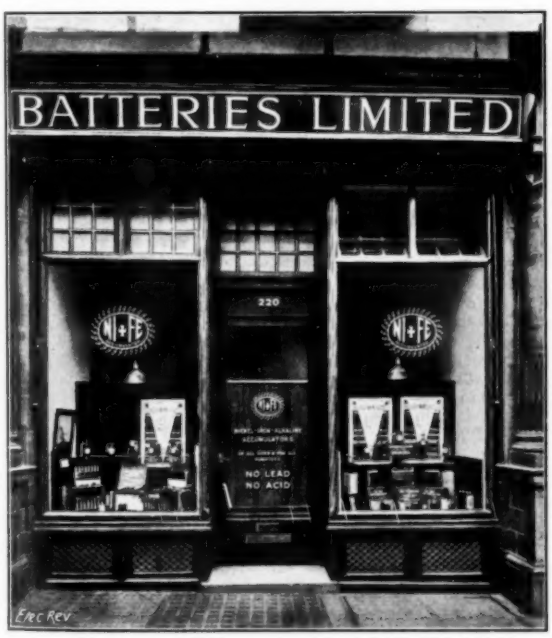
Advertising "Osram" Valves.—The GENERAL ELECTRIC CO., LTD., has produced a new series of effective advertisements of "Osram" valves. These introduce two personified qualities—Messrs. Tone & Power in a variety of themes.

A Japanese Catalogue Library.—The Service Department of the Kogyo Hyoron Sha, publishers of *The Japan Industrial Review* (Kogyo Hyoron), at 6, Chome Itachibori, Osaka, Japan, informs us that it is establishing a Catalogue Library, including catalogues of machinery, tools, supplies, and all industrial goods, which will be open to the public. The intention is to make it a centre of information for Japanese buyers, where they can learn "what are offered" and "where to buy," and it is hoped that the library will serve the world's commerce by accelerating and promoting business between Japanese buyers and European sellers. British manufacturers would do well to send copies of their catalogues, and to keep them up to date by forwarding new editions directly they are issued. The catalogues will be carefully filed, and their receipt will be recorded in the magazine free of charge.

The Leipzig Spring Fair.—We have received from the London honorary organising secretary, 1, Gower Street, W.C.1, a pamphlet dealing with the Leipzig International Industries Spring Fair, which is being held from March 6th to 12th next. This explains fully the arrangements made with regard to the British section.

"Hart" Batteries and Automatic Telephones.—In connection with the description of the automatic telephone exchanges at Edinburgh, which appeared in our issue of November 12th, we are informed that "Hart" batteries are installed at each of the four exchanges referred to. In the case of the Central Exchange, possessing an initial equipment of 9,300 lines, the capacity of the batteries is 3,666 ampere-hours; at the other exchanges the batteries are of 400-500-Ah capacity. Many other telephone exchanges have installed "Hart" batteries, both at home and abroad.

New London Battery Showroom.—BATTERIES, LTD., of Redditch, has opened a new showroom and service depôt at 220, Shaftesbury Avenue, W.C.2. A view of the premises



New London Showroom (Batteries, Ltd.).

accompanies this note. At the depôt every facility is available for recharging and maintaining the company's batteries, which are of the "Nife" type (alkaline).

A Draughtsman's Diary.—We have received a copy of the pocket-diary issued by the Association of Engineering and Shipbuilding Draughtsmen for 1927; the data section has been freely revised, it being the aim of the Committee in charge of it gradually to change the contents without increasing the bulk of the book, and to include tables and data not readily accessible by other means. An index to the current and preceding issues is provided. It appears to be a very useful pocket companion.

Meter Approved.—The Electricity Commissioners have approved of the construction, pattern, and method of fixing the meter manufactured by the British Sangamo Co., Ltd., known as the "Sangamo" Type S2 induction watt-hour meter, rated from and including 2.5 amps. to 25 amps., 110 to 550 V inclusive, at a frequency of 50 cycles.

Indian Electrical Imports.—The value of the imports of electrical equipment into India during September is returned at only 1,510,000 rupees, as compared with 3,400,000 rupees in the corresponding month of last year.

Recent Contracts.—THE GENERAL ELECTRIC CO., LTD., has recently shipped part of an important contract for machinery for a Canadian gold-mining company. The contract comprises two electrically-driven winding engines of 2,450 h.p. and 1,400 h.p. respectively, and was obtained in the face of severe American competition. The whole of the electrical equipment has been manufactured at the company's Witton works. It consists of two d.c. motors controlled upon the Ward Leonard system. The mechanical gear was made at the Fraser & Chalmers Engineering Works.

MESSRS. PETTERS, LTD., report the receipt of many overseas orders for their engines in combination with generators. Sets have been shipped to Australia, British Columbia, India, Ceylon, and Iraq, and an order has been received from the Portuguese Admiralty for two sets for ship lighting.

Price Reductions.—The ATHOL ENGINEERING CO. announces reductions in the prices of its coil mounts and valve holders.

Trade Announcements.—MR. C. F. PARDOE, Clarence Street, Hull, is carrying out extensions which will nearly double the capacity of his works. Mr. Pardoe states that since the death of Mr. Schuil, of the Schuil Engineering Co., Hebburn-on-Tyne, he has bought all the firm's stock of starter parts, and is dealing with inquiries regarding these products.

The Birmingham branch of BURNDEPT WIRELESS, LTD., has been transferred to 2 & 4, Albert Street. The branch is now under the management of Mr. Albert Illing, who was formerly with the Sterling Company.

THE LONDON MAGNETO REPAIRING AND WINDING CO., LTD., 78, Hampstead Road, Euston, N.W.1, has been appointed by the Westinghouse Electric International Co. as "servicing agents" for Great Britain and Ireland for "Westinghouse" automobile starting and lighting equipment.

A correspondent states that important extensions are being made by the BRITISH THOMSON-HOUSTON CO., LTD., at Coventry, where the premises of the Auto Machinery Co. have been purchased for the expansion of business in magnetos, &c.

Catalogues and Lists.—THE PULSOMETER ENGINEERING CO., LTD., 11, Tothill Street, Westminster, S.W.1.—A pamphlet describing and illustrating the new "Pulsometer" motorless refrigerator.

MESSRS. STEWART, THOMSON & PATRICK, LTD., 10-14, Hart Street, London Road, Liverpool.—Two illustrated and priced leaflets advertising bowl fittings for electric lighting.

THE UNITED ELECTRICAL CO. (BIRMINGHAM), LTD., 47, Summer Row, Birmingham.—A list containing illustrations and prices of "Baby Coolex" distribution boards.

MESSRS. FALK, STADELMANN & CO., LTD., 83-93, Farringdon Road, E.C.1.—Catalogue No. 582, a supplementary list of electric lighting accessories, including conduit and fittings, switches, fuseboards, cables, &c.

MESSRS. BELBIN & BOWDEN, LTD., 3, Finsbury Square, E.C.2.—Folder No. 7, containing prices and particulars of "Bow Bells" electric lamps.

LIGHTING TRADES, LTD., 51-57, Garratt Lane, Wandsworth, S.W.18.—A catalogue of decorative glassware for electric lighting.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—A "Christmas Suggestions" booklet containing prices and illustrations of fires, radio sets, vacuum cleaners, and many other appliances suitable as gifts.

MR. M. W. WOODS, 3, Denman Street, London Bridge, S.E.1.—An illustrated pamphlet advertising "M.W." battery-charging equipment. Priced.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1.—Pamphlet WI 5C, introducing a new aerial fuse for the protection of overhead distribution lines.

MESSRS. YOUNG & WILDSMITH, 20, Bloomsbury Street, W.C.1.—An illustrated and priced list of switch plates.

Bankruptcy Proceedings.—G. WINTERSGILL, Hawnby Road, Linthorpe, Middlesbrough, electrical engineer.—The public examination of this debtor was held recently at the Court House, Middlesbrough. The gross liabilities were returned at £396, and there was a deficiency of £388. Debtor said that his deficiency was accounted for by the balance owing upon his house on which he had obtained a mortgage from a building society. It was stated that a certain gentleman who had been in partnership with the debtor had accepted responsibility for the latter's bank overdraft, and in view of the acceptance of the property, subject to mortgagee interest, by the creditor building society, the Official Receiver intimated that the bankruptcy would be annulled.

R. L. BROCK, trading as R. L. Brock & Co., electrical engineer, 5, Bedford Row, Tavistock Road, Plymouth.—A meeting of creditors was held at the office of the Official Receiver, Plymouth, on November 24th. Debtor estimated his liabilities at £5,100, with £1,722 expected to rank for dividend. The assets were estimated to produce £355. Debtor said that bad trade, heavy expenses and losses in partnership were the causes of his failure. December 31st was fixed for the public examination, and Mr. J. S. Bradley Hole, Monument House, Monument Street, E., was appointed trustee.

E. F. WOODGATE, electrical engineer, 7, St. John's Terrace, Weymouth.—Receiving order made November 19th, on debtor's own petition.

R. P. REEVES (Lux-ray Spotlight Projector Co.), electrician, 5, Say's Corner, North Quay, Great Yarmouth.—Receiving order made November 18th, on debtor's own petition.

J. SEGAL, gas and electrical accessories merchant, 2, Vine Street, Tooley Street, S.E.—Trustee, Mr. C. Latham, 78, New Oxford Street, W.C.1, appointed November 15th.

F. H. P. HOOLAHAN (Holloway Bros.), electrical engineer and instrument maker, 16, The Hale, Highams Park, and 299, Holloway Road, N.—Trustee, Mr. E. Parker, Official Receiver, Carey Street, W.C., released November 16th.

H. C. HALL (The Pantechnicon), electrical and fancy goods dealer, 5, Chapel Street, Penzance.—First and final dividend of 6¾d. in the £, payable at the Official Receiver's Office, 12, Princes Street, Truro.

C. W. WATSON, electrical and wireless engineer, 33, Rainhall Road, Barnoldswick, Yorks.—Receiving order made November 24th on debtor's own petition.

A. J. MCMAHON, electrical contractor, 51, St. Thomas Street, Weymouth, and Melcombe Regis.—First meeting, December 7th, at the Official Receiver's office, City Chambers, Catherine Street, Salisbury. Public examination, December 10th, at the County Hall, Dorchester.

P. F. BRITTAIN (Brittain's Electric Motor Co.), electrical engineer, Norfolk Hotel, Folkestone, East Down Works, Dermody Road, Lewisham, S.E., and 110, Cannon Street, E.C.—Trustees, Mr. W. A. J. Osborne, Balfour House, 119, Finsbury Pavement, E.C., and Mr. J. H. Hodson, 69, Basinghall Street, E.C., appointed November 22nd.

P. W. HORNE (Horne Bros.), electrical engineer, 260, Linthorpe Road, Middlesbrough.—Last day for proofs for dividend, December 13th. Trustee, Mr. C. L. Townsend, 80, High Street, Stockton-on-Tees.

C. E. F. PARKER, electrical engineer, Greendale, Privett Road, Gosport.—Last day for proofs for dividend, December 11th. Trustee, Mr. H. Aston, 87, High Street, Portsmouth.

H. H. ATKINSON, electrical engineer, 33, Princess Avenue, Old Trafford, Manchester.—Last day for proofs for dividend, December 11th. Trustee, Mr. J. G. Gibson, official receiver, Byrom Street, Manchester.

Company Liquidations.—MILLER & SONS, LTD., New Burlington Street, London, W., electrical engineers, &c.—A meeting of creditors was held on November 25th, at the offices of Messrs. G. Dixey & Co., C.A., 9a, Sackville Street, W. Mr. C. J. Dixey, the liquidator, occupied the chair, and submitted a statement of affairs which showed liabilities of £967, of which £708 was due to the trade, and £259 was owing in respect of directors' fees, &c. The net assets were £230, leaving a deficiency of £737. The liquidator said that the book-debts might produce £900, and the assets would accordingly be increased by about £200. The chairman reported that the business was a very old-established one, and the limited company was formed in 1900, the issued capital being £11,553. With the introduction of electric light the business suffered considerably, and it was decided to take up that branch. The electrical department, however, was not opened soon enough, and several ventures which were made did not turn out well. There was an investment of £500 in another company, which made fittings, and that amount was entirely lost. There was also an investment in a concern which produced artistic fittings for lamps, and up to date there had been a loss of £2,000, although some small amount might be recovered. There was a third investment in a company which was formed to refill electric light bulbs, and in that direction about £300 was lost, and there were losses on contracts. The losses would have been increased had further depreciation been written off the assets. Debentures were issued to the bank in 1913 for £2,500, but less than £900 was now due to the bank. The lease of the premises might prove to be of some value. A resolution was passed confirming the voluntary liquidation of the company, and an advisory committee was appointed consisting of the representatives of Messrs. J. C. & J. Field, T. & H. Sowerby, and G. S. Peckham & Co. The principal creditors are:—

	£		£
J. C. & J. Field	189	G. S. Peckham & Co.	72
T. & H. Sowerby	193	Swan Electric Co.	50

A. E. TRIBE & CO., LTD., electrical and radio engineers, 18, London Road, Basingstoke.—A meeting of creditors was held on November 25th, at the offices of Messrs. R. J. Ward and Co., C.A., 10, Serjeants' Inn, E.C. The chair was occupied by Mr. W. Boniface, the liquidator in the voluntary liquidation of the company, who recalled that a private conference of the creditors was held last August, when a statement of affairs was presented which showed unsecured creditors of £1,889, and a deficiency of £1,192. The creditors then resolved to accept a composition of 3s. 6d. in the £ in settlement of their claims. To enable that composition to be paid the company issued debentures for £300 for cash. Creditors to the extent of £1,236 accepted the composition, and they were duly paid. Other creditors, however, continued legal proceedings, and finally an execution was levied. The holder of the debenture then appointed a receiver, and there was no alternative but for voluntary liquidation to take place. At the date of the appointment of the receiver the liabilities were £746, the directors having since last August advanced further amounts to the company. After allowing for the debentures and preferential claims there was a deficiency of £482 so far as the creditors were concerned. The company was registered in November, 1923, with a nominal capital of £1,000, of which £500 was issued for cash. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued with Mr. Boniface as liquidator.

GWYNNES, LTD., Victoria Street, S.W.1.—The first meetings of creditors and shareholders were held on November 26th, at Carey Street, before Mr. G. D. Pepys, Official Receiver. The winding-up order was the result of a Crown petition; the statement of affairs showed liabilities of £228,895, of which excess profits duty due accounted for £205,000; the assets were put at £1,994, but have realised a little more. Mr. W. G. Gwynne, managing director of the company, attributed the position to the failure of a new company (Gwynne's Engineering Co., Ltd.), which was formed to take over the business, to pay the stipulated cash consideration, &c. The liquidation was left in the hands of the Official Receiver.

WIRELESS EXPERTS, LTD.—A meeting of members is called for December 29th at the Belgravia Hotel, Grosvenor Gardens, S.W.1, to hear an account of the winding up from the liquidator, Mr. D. V. L. Craddock.

WALTON'S WIRELESS (NEWCASTLE-UPON-TYNE).—A meeting of members is called for December 23rd, at 2, Saville Place, Newcastle-upon-Tyne, to hear an account of the winding up from the Liquidator, Mr. R. M. Graham.

SCHEFF PUBLICITY ORGANISATIONS, LTD.—Winding up voluntarily. Liquidator, Mr. P. S. Booth, Kimberley House, Holborn Viaduct, E.C. A meeting of creditors was held on November 24th at Anderton's Hotel, Fleet Street, E.C. Particulars of claims to be sent to the liquidator by December 19th.

British Electric Vehicles, Ltd.—Messrs. Wingrove and Rogers, Ltd., of 63, Queen Victoria Street, E.C.4, write as follows:—"We notice on page 877 of your issue of November 26th particulars of the liquidation proceedings of British Electric Vehicles, Ltd., of Southport. In this connection we would like to draw your attention, and that of your readers, to the fact that we have purchased the whole of the assets of British Electric Vehicles, Ltd., for cash, and are now carrying on the manufacture of all their standard vehicles in our Liverpool factory. This company was registered in 1919, since when we have had a successful record of trading, principally as manufacturers of wireless apparatus, controllers, switchgear, and spiral and rod clock gongs. Throughout the whole of this period we have made the whole of the controllers fitted by British Electric Vehicles to their trucks and locomotives."

Private Arrangements.—NEUTRON, LTD., Sentinel House, Southampton Row, W.C.1, radio accessory manufacturers.—An informal meeting of creditors of this company was held on November 26th, when Mr. Booth, a creditor, was elected to the chair. The solicitor to the company stated that the meeting had been convened in order to place before the creditors certain proposals whereby it was hoped to continue trading and eventually discharge the liabilities in full. There had been insufficient time to allow the auditors to prepare complete accounts, but from figures given him it appeared that the assets were valued at £3,391; no allowance was made for trade marks and goodwill. The liabilities consisted of: Debentures £3,450, and unsecured trade creditors £4,271. The company was registered on May 3rd, 1924, with a nominal capital of £500, and the turnover to date had been approximately £100,000. It had expended £20,000 in advertising, £13,000 in this country and £7,000 abroad. The first debenture, for £300, was issued some time ago, and subsequently a second debenture for £2,500 was created, in both cases the consideration being cash. The second debenture matured in October last, when an arrangement was entered into whereby a new debenture amounting to £3,150 was given in exchange for the old debenture and the advancement of a further sum of money. Last July the board was reorganised, and it was anticipated that under efficient management the company would be placed on a more satisfactory footing. It was proposed that all creditors under £10 should be paid in cash within two months, and that the claims of the larger creditors should be paid by instalments, bills being given payable at three, six, nine and 12 months. Mr. Mar, on behalf of the largest debenture holders, expressed their willingness to help as far as possible. Other creditors pressed for something more definite, and after consultation with the chairman it was announced that in order to aid the scheme Mr. Mar would agree to come in with the creditors in so far as the next 12 instalments under the debenture were concerned, and take bills in connection therewith. After some discussion it was resolved to approve the scheme and the arrangement suggested with the debenture holders, and two of the creditors were appointed members of the board to report to the creditors in the event of anything arising detrimental to the scheme. The following are creditors:—

	£		£
Benjamin Electric, Ltd.	25	Hare & Co., Ltd.	34
Birkby's, Ltd.	60	Knighton & Cutts	30
Elvy, Robb & Welch	154	Lawwol Co.	206
Gaskell & Baggaley	60	Lifford Engineering Co.	50
Green, S. T.	30	Provincial Exhibitions, Ltd. ...	20
Graphic Arts Press	60	*Radio World*	35
Golly Garage	36	Sessions, William	76
Gale & Polden, Ltd.	75	Radio Amateurs	28
Hunt Partners	90	International Office Service ...	80
Hunter, Edward	675	Radio Luistergids	134
Houghton's Electric Engineering Co., Ltd.	84	Radio Gids	37

New Municipal Showrooms and Offices.—The Barking Town Electricity Committee has suggested a site in Ripple Road for the erection of electricity showrooms and offices.

Unemployment.—There was a decrease of 11,459 in the total of registered unemployed as at November 15th. The number was 1,551,500, as compared with 1,562,959 on November 8th and with 1,196,237 on November 16th, 1925.

Social Event.—A dance and concert will be held at Balham on December 22nd by the staff of the Normand Electrical Co., Ltd.

The British Industries Fair.—It was officially announced last week that the whole of the space in the British Industries Fair, which is to be held simultaneously in London and Birmingham from February 21st to March 4th next, had been taken with the exception of a few spaces rendered vacant in the Birmingham section by extensions of the Castle Bromwich premises. "No more applications for space in the London section at White City, Shepherd's Bush, can be considered," an official of the Department of Overseas Trade stated. "Space has been snapped up at the rate of 1,200 square feet a day lately, and the amount asked for is well in excess of what is available. In the Birmingham section, which is being organised by the Birmingham Chamber of Commerce for the hardware, building, engineering, electrical and other 'heavy' industries, booking of space has exceeded by 25,000 sq. ft. the total space available in the 1926 display, which itself beat all previous records."

Book Notices.—Scientific Papers of the U.S.A. Bureau of Standards. Vol. 21, No. 530. "Establishment of Radio Standards of Frequency by the Use of a Harmonic Amplifier"; No. 531, "A Principle Governing the Distribution of Current in Systems of Linear Conductors."

"The China Year Book, 1926-7." London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. Price 42s. net.

"The Whitworth Book," prepared by the Whitworth Society. Hon. editor, D. A. Low. Pp. vi+316. London: Longmans, Green & Co., Ltd. Price 10s. 6d. net.

"Wireless Pictures and Television," by T. Thorne Baker. Pp. x+188; figs. 99. London: Constable & Co., Ltd. Price 6s. 6d. net.

"Science Abstracts" (A and B). Vol. XXIX. November 25th, 1926. Part II. London: E. & F. N. Spon, Ltd. Price 3s. each.

"The Brown Budget." November. North Acton: S. G. Brown, Ltd.—This is the first anniversary number of the periodical; it contains portraits of the company's officials and agents, and deals with its activities generally.

Electrical Trades Commercial Travellers' Association.—The annual meeting of this Association was held on November 19th, when reports were read and adopted. Sir Hugo Hirst, Bt., was appointed to succeed Mr. C. W. Sully as president. Mr. A. S. Markes was elected chairman and Mr. F. W. Peers vice-chairman.

New Australian Company.—The Australian Wireless Co., Ltd., was recently formed in Sydney (N.S.W.), with a capital of £25,000 to acquire an existing business and to manufacture and sell radio apparatus.

Trinidad Trade Commissioner's Address.—The British Trade Commissioner in Trinidad (Mr. J. L. Wilson Goode) has a new office at: Canadian Bank of Commerce Building, Abercromby Street, Port-of-Spain (P.O. Box 225).

The Magnetic Testing of Steel.—In our issue of August 27th, 1926, p. 356, we published an article describing a new process which had been evolved by the Equipment & Engineering Co. for the detection of flaws in steel. It will be recalled that the metal to be tested is highly magnetised and then bathed in a special fluid containing finely-divided iron. It is interesting to learn that the associated companies of the London Underground railways have adopted the principle of this process for the testing of axles and wheels at their Acton works.

Lighting and Power Notes.

Ashby-de-la-Zouch.—INQUIRY.—The Electricity Commissioners have informed the Rural District Council that they propose to hold an inquiry on January 4th at Tamworth into two applications by companies for powers to supply electricity within the rural area. The Leicestershire and Warwickshire Electric Power Co. has given the Council notice of its intention to lay underground mains at Measham.

Australia. — VICTORIAN ELECTRICITY COMMISSION. — The accounts recently presented to Parliament by the Auditor-General on the operations of the Electricity Commission for the year ended June 30th last show a loss of £262,275. In the preceding year there was also a deficit of £335,663, making a total loss for the two years of £597,938. The interest capitalised to June 30th last totalled £1,139,265, for which there are no assets, and upon which the Commission will pay interest until the debit is written off out of profits. The capital cost of the Yallourn scheme now stands at £4,361,705, and of the metropolitan supply system £2,546,302.

Ayrshire.—ELECTRICITY AGREEMENT.—An agreement between the Ayrshire Electricity Board and Girvan Town Council with regard to a supply of electricity by the Board in the Council's area has been signed.

Barking Town.—EXTENSION OF SUPPLY.—The Electricity Committee is considering the provision of an electricity supply to the Ripplesde area, at a cost of £3,250.

Bedford.—LOANS.—The Electricity Committee is applying for sanction to further loans of £20,000 for mains and £5,000 for transformers and switchgear.

MAINS EXTENSIONS.—The Electricity Committee has voted a sum of £2,360 for mains extensions.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The *Financial Times* states that schemes for new hydro-electric power developments on a large scale are reported from Ottawa. At the forthcoming session of the Quebec Provincial Parliament proposals will be submitted for harnessing the Carillon Rapids on the Quebec River, estimated at from 300,000 to 350,000 h.p. An agreement has been reached between the Quebec and Ontario Provinces as to rights and apportionment between the two Provinces of the power generated, and the construction of the dam (estimated to cost £7,000,000) will be undertaken by a private company. A market for the power is assured by steady industrial expansion. A new concern—the Spruce Falls Power and Paper Company—is building at Smoky Falls (Ontario) a hydro-electric power plant, and at Kapuskasing a pulp and paper manufactory to cost over £5,000,000. Big schemes are also in hand in the Maritime Provinces. The Ontario Government is this year spending nearly £200,000 in erecting over 100 miles of transmission line to supply remote farming communities.

Cardiff.—PROPOSED LINKING-UP.—The Corporation Electricity Committee has received a communication from Newport Corporation suggesting that consideration be given to the establishment of an inter-connection system between the two electricity undertakings, and has instructed Mr. Morley New, borough electrical engineer, to confer with the electrical engineer of Newport on the subject.

Cockermouth.—ELECTRICITY SUPPLY.—According to the *Manchester Guardian*, the Rural District Council on November 23rd adopted a recommendation of the Electricity Committee that the Workington Electric Power Co. be asked to submit terms for the supply of 100,000 kWh, 300,000 kWh, and 500,000 kWh per annum, with a peak load of 500 kW, to a number of mining and agricultural villages in the Derwent Valley. Seaton has already decided to light the village with electricity. It is hoped to induce the Cockermouth Urban District Council to join the scheme, and in that case the Rural Council would apply for an Order to carry out the scheme. At present in most of the villages the only lighting is by oil.

Croydon.—HIRING OF DOMESTIC APPLIANCES.—The Electricity Committee has allotted a sum of £5,000 for the purchase of domestic apparatus to be let out on hire.

Edinburgh.—PROPOSED CHANGE-OVER.—The Corporation has applied to the Electricity Commissioners for consent to alter its system of electricity supply from d.c., 3-wire at 230 and 460 V, to a.c. 4-wire, 50 cycles, at 230 and 400 V. The change will be effected gradually.

Glasgow.—PROGRESS DURING OCTOBER.—The electricity manager has reported to the Corporation that during October 174 houses were wired, making the total to date 2,851, and number of domestic appliances let out on hire was 1,349, making the total to date 12,641.

Irish Free State.—LIMERICK.—At a meeting of the Electric Lighting Committee recently the question of a supplementary supply of electricity from Messrs. Siemens Bau-Union was discussed, and it was decided to apply to the Local Government Department for sanction to a loan of £25,000 for installing the necessary plant to take a supply from the Shannon scheme.

London.—ST. PANCRAS.—The Electricity Committee is seeking sanction to borrow £44,000 for electricity purposes.

BATTERSEA.—The Electricity Committee has recommended the installation of a second 10,000-kW turbo-alternator, &c., at an estimated cost of £98,000.

HACKNEY.—The Electricity Committee has decided to obtain a loan of £13,993 for street-lighting equipment, &c.

FULHAM.—The Electricity Committee has received sanction to the borrowing of £11,500 for mains and £6,000 for sub-station equipment.

ST. MARYLEBONE.—The borough electrical engineer has reported to the Electric Supply Committee that the Zoological Society has decided to use electricity for heating, as well as lighting, in the animal houses which are being modernised. Requirements in the near future are expected to total 750 kW, with an annual consumption approaching 4,000,000 kWh, and may ultimately considerably exceed this figure. To provide a supply it will be necessary to lay an e.h.p. cable from the power station and install a transformer and h.p. switchgear, the cost being estimated at £8,400. The Committee has recommended that application be made for sanction to a loan to cover the cost of the scheme.

In connection with the bulk supply of electricity to Hampstead Borough Council, it is recommended that an approximate reduction of 5 per cent. be made in the charges, and

that an expenditure of £3,800 be approved for further cable, &c., to meet the increasing load.

POPLAR.—The Electricity Committee is applying for sanction to a loan of £50,000 for services, meters, and wiring installations.

Llanfairfechan (North Wales).—ELECTRICITY SCHEME.—The Urban District Council has appointed Mr. Price White, electrical engineer to the Bangor Corporation, as consulting engineer for its electric street-lighting scheme.

Millom.—ELECTRICITY AGREEMENT.—At a meeting of the Urban District Council on November 19th it was decided to sign the contract for a supply of electricity to the district. Electricity will be obtained from the Millom Ironworks Co., and converted by the Council to suitable voltages for domestic use. Sanction has been received to a loan of £6,000 toward the cost of the scheme, which is estimated at £10,000.

Preston.—ELECTRICITY SUPPLY.—At a meeting of the Town Council on November 25th, the chairman of the Electricity Committee stated that the price of electricity would not be raised. The dispute had cost the Corporation £16,000. The breakdown which occurred recently was due to cheap fuel. The question of the Blackburn connection would be discussed between the two Corporations to see if the stations could be linked up, both of which were now loaded. Fifty miles of new cable had been laid in 2½ years, and the load was now 11,800 kW, as compared with 3,400 kW when the Corporation bought the station.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

TWICKENHAM.—*Twickenham and Teddington Electric Supply Co., Ltd.*—Lighting, heating, and power: An increase of ½d. per kWh.

OLDHAM.—An increase of 10 per cent.

HACKNEY.—An increase of 25 per cent.

POPLAR.—An increase of 15 per cent.

BARKING.—Lighting: An increase of 1d. per kWh. Power: An increase of ½d. per kWh.

Rhyl.—INAUGURATION OF SUB-STATIONS.—Three new sub-stations were formally inaugurated by the chairman of the Electricity Committee on November 20th. The cost of the new stations was £3,500.

South Africa.—CAPE TOWN.—According to the *South African Engineer*, the City Council has recently completed the work upon which it has been engaged during the past nine months of replacing the whole of the overhead distribution system in the central city area by underground cables, and of substituting, for street lamps previously in use, others of a higher candle power and designed to eliminate glare as far as possible, at a total cost of approximately £16,500. The improved lighting system has been installed in all the principal streets, and its success has been such that it is being gradually extended to all of the main roads leading into and from the city. A further step in the development of the electricity supply is the recent grant to the City Council by the Electricity Control Board of permission to supply electrical energy to all prospective consumers in the Peninsula west of a line drawn through Milnerton and Strandfontein. Negotiations have recently been concluded between the Council and the Camps Bay Tramway Co., Ltd., whereby the latter will shut down its existing generating station at Camps Bay and will take a supply of electricity from the Council for traction purposes and for lighting and power purposes in its tramsheds and workshops at a flat rate of 1.062d. per kWh.

Special Orders.—Application has been made to the Electricity Commissioners by the Electric Supply Corporation, Ltd., for a Special Order authorising it to supply electricity in certain parishes in the rural districts of Cuckfield and Chailey.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Cranleigh Gas and Coke Co., Ltd., to supply electricity within part of the rural district of Hambledon, and the Whitstable Electric Co., Ltd., to supply in part of the rural district of Blean.

Stoke.—TRANSFER OF UNDERTAKING.—The Electricity Committee has appointed a sub-committee to consider the terms and conditions of transfer of generating stations to the Joint Electricity Authority when formed. A communication has been received from the Electricity Commissioners stating that, after consideration of the evidence given at the local inquiry, held in February last, and on further information furnished, the Electricity Commissioners have decided to prepare a draft order embodying a scheme for a Joint Electricity Authority for the North-West Midlands Electricity District.

LOAN SANCTIONED.—Sanction has been received to a loan of £4,000 for plant at the Burslem sub-station.

RAILWAY SUPPLY.—The Committee is to enter into an agreement with the London, Midland & Scottish Railway Co. for the supply of electricity at Burslem, Longton, and Stoke, and additional supplies required at Hanley and Stoke railway stations. The company will take a supply at 6,600 V at Stoke railway station, with a minimum of 330,000 kWh per annum and 133 kW, the charge to be £4 per kW per annum, plus ½d. per kWh for electricity consumed, the kWh charge to vary according to the rise or fall in the cost of coal. The agreement will cover a period of not less than five years.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—The *Electrical World* reports that the Detroit Edison Company has decided to erect a new generating station, which will be able to accommodate eight 50,000-kW sets, two of which will be put into operation in 1928.

The Federal Power Commission has under consideration reports of an investigation into applications by the Tennessee Hydro-Electric Co., the East Tennessee Development Co., and the Union Carbide Co. for preliminary permits for the hydro-electric development of the Tennessee River and its tributaries above Chattanooga. About 250,000 h.p. of primary capacity and a probable installation of more than 500,000 h.p. are involved.

The Commission has received an application from the Savannah River Electric Co. for permission to construct a hydro-electric power station on the Savannah River, 21 miles above Augusta, Ga., at a cost of $20,000,000. The plant, which is to be completed by 1930, will ultimately be equipped with four 30,000-h.p. sets.

Uttoxeter.—ELECTRICITY IN BULK.—The consulting engineer to the Urban District Council is inquiring from the Stoke Corporation terms for a bulk supply of electricity to the district.

Wirral.—ELECTRICITY AGREEMENT.—The Rural District Council has signed a provisional agreement with Birkenhead Corporation for the supply of electricity by the Corporation in the rural district.

Tramway and Railway Notes.

Bolton.—DOUBLING OF TRACK.—The Corporation Tramways Committee is to double the tramway track in Wigan Road as far as Beaumont Road. The work is to be completed in time for the Royal Lancashire Show next year.

Burnley.—NEW ROUTE.—The Town Council has approved a recommendation to construct a tramway along Gunsmith Lane to Yorkshire Street, at an estimated cost of £2,900. The line will afford an alternative route for traffic for Todmorden Road and Brunshaw Road from the Nelson area.

Continental.—BULGARIA.—After the Sofia city budget has been passed, an adjudication will be made for 30 new tramcars, costing about 40,000,000 leva. These cars are to be 1½ metres longer than those now in use, and will have a motor of 120 h.p. instead of 90 h.p. The installation of machinery at the Boiana transforming station has commenced; this station will have a capacity of 550 h.p. at first, but the capacity will eventually be doubled.—*Reuter's Trade Service* (Sofia).

SWITZERLAND.—It is estimated that the cost of electrifying the Richterswil-Chur and Sargans-Buchs section of the Swiss railways will amount to £423,600. Of this sum £128,240 has been reserved for expenditure up to the end of 1927. The electrification work on the Zurich-Schaffhausen line is estimated to cost £140,000, of which, however, only £8,500 will be allotted to 1927.

East Ham.—INQUIRY.—A Government inquiry was held recently at the Town Hall into the proposal of the Town Council to institute a railless-car system.

Hull.—OMNIBUS FARES.—The *Manchester Guardian* reports that the Ministry of Transport has dismissed the appeal of H. C. Motors, Ltd., against the Corporation, which made it a condition in licensing motor-buses that the fares must be 1d. in excess of the tram fare charged on that portion of the route within the city boundary along which tramcars run.

Provisional Orders.—Applications have been made to the Minister of Transport for Provisional Orders by the following authorities:—Rotherham and Southend-on-Sea Corporations, to introduce railless-car services in their boroughs; St. Helens Corporation, to run railless cars on certain routes in the borough, the urban district of Haydock and the township of Windle; the Mexborough and Swinton Tramways Co., to run railless cars in the urban districts of Mexborough, Swinton, Rawmarsh, Greasbrough, Bolton-upon-Dearne, Wath-upon-Dearne, Conisbrough, and the parish of Adwick-upon-Dearne; and the Cardiff Corporation, to construct new tramways in the borough.

London.—UNDERGROUND "HOLD-UP."—The speed of the trains on the Underground railways was considerably reduced on November 29th, and although later in the day it was found possible to increase the power, the services were reduced by 10 per cent. The Underground Railways Co. stated that owing to a temporary shortage of steam power at the Chelsea power station the trains on the Underground (Metropolitan District Railway and Tube lines) were running at half speed. The cause was attributed to the use of inferior foreign coal.

CHRISTMAS TRAMWAY SERVICE.—At a meeting of the L.C.C. on November 23rd, the Highways Committee reported that it was proposed to discontinue the tramway service on Christmas day at approximately 4 p.m. It was not proposed to run the ordinary night services on Sunday morning, December 26th.

TRANSPORT PROBLEMS.—The London and Home Counties Traffic Advisory Committee has issued two reports containing recommendations for easing the Metropolitan transport problems. Included in the reports are proposals for the electrification of the suburban section of the L. and N.E. Railway, a connecting link between the Metropolitan Electric Tramways and the undertaking of the Walthamstow Urban District Council, and the extension of the Piccadilly Railway to Manor House and Wood Street, or Southgate.

Sheffield.—NEW CARS.—The Corporation Tramways Committee proposes to order 50 new tramcars, half of which will be built by contract and half by direct labour.

United States.—RAILWAY ELECTRIFICATION.—According to the *Electric Railway Journal*, orders have been placed by the Pennsylvania Railroad for 128 electric passenger cars for operation on the southern division main line between Philadelphia and Wilmington, Del., and the Octoraro branch between Philadelphia and West Chester, Pa. The equipment is expected to be delivered by November, 1927. The electrification of these lines constitutes one of the most important projects of its kind undertaken in recent years. It involves approximately 52 route miles of line and 150 miles of track. Its consummation will give the Pennsylvania Railroad a total of 90 route miles and 264 miles of track electrified for suburban service directly in and out of Philadelphia. In addition, the Camden-Atlantic City electric line provides Philadelphia with an extensive suburban service *via* the Delaware River ferries. The electrification schemes to Wilmington and West Chester are an integral part of the Pennsylvania Railroad's plan for its new main Philadelphia passenger station on the west bank of the Schuylkill River and the extension of electric suburban service into a centrally-located underground terminal near the site of the present Broad Street station in Philadelphia.

PURCHASE OF RAILWAY SYSTEM.—The New York correspondent of the *Daily Mail* reports that the Chicago, Milwaukee, and St. Paul Railway was sold by auction at Butte, Montana, on November 22nd to the Reorganisation Committee, a group of New York bankers, for a sum of £28,000,000. Part of the system is electrified.

Telegraph and Telephone Notes.

"Beam" Radio-Telegraphy. — NEW STATIONS. — New "beam" stations for communication with New York and South America are to be erected by Marconi's Wireless Telegraph Co. A station is also to be erected in Portugal to connect Lisbon with Portuguese colonies in Africa.

Long-distance Telephony.—NEW SUBMARINE CABLE.—A new telephone cable in the Baltic Sea, between Denmark and Germany, is to be laid shortly to provide for faster and more distinct telephone calls. This new cable will connect with the large underground telephone cable which Germany has recently completed, and will be from Nykoing, Falster, Gedser, Warnemunde, and Rostock. Communication between Copenhagen and Germany has been carried on in the past through a cable containing only four wires, but this old cable could not be connected with the new German telephone system. The new cable, however, will be more than ample to take care of present requirements, carrying a sufficient number of wires so that twelve telephone calls can be provided for at one time. The cost of the new cable is to be divided equally between Denmark and Germany, but the actual work of laying it in the Baltic Sea is to be done by Germany.—*T. & T. Age.*

Telegraph Transmission Speeds. — CABLE *versus* WIRELESS.—The Sydney correspondent of the *Daily Telegraph* reports that Mr. J. A. J. Hunter, member for Maranoa in the House of Representatives, has stated that the speed of the new duplicated Pacific cable is 1,000 letters a minute, and contrasted this with 500 letters by the "beam" radio system from London to Montreal. Mr. E. T. Fisk, managing director, Amalgamated Wireless (Australasia), Ltd., retorts that the guaranteed capacity of the "beam" service from London to Montreal is double Mr. Hunter's figure. In actual practice, in a seven days' continuous test, the average working speed was 1,200 letters a minute for a 24-hours' day. Speeds of 2,500 letters a minute were worked on a complete circuit for many hours. Mr. Fisk states that this shows considerably greater capacity than that claimed for the new cable.

The Telephone Service.—NEW EXCHANGE.—The automatic exchange which was opened at Coventry recently has switching apparatus for 3,300 subscribers' exchange lines, and will ultimately have a capacity of 4,900 lines. The manual equipment consists of 18 operators' positions for trunks, junctions, and special services. The power plant and secondary cells includes two sets of 25 cells each, with a voltage of 50, and 1,750 ampere-hour capacity, and two 20-kW generator-charging sets. A satellite exchange at Foleshill works on the Coventry exchange with a capacity for 500 subscribers' lines, which will ultimately be 900.

Radio Notes.

France.—NEW STATION.—In connection with the new broadcasting station which is to erected, a *Reuter* message from Paris states that the Union of Radio-Electric Industries proposes to erect the station at some distance from Paris in order that receiving posts may be caused no inconvenience. The power of the station will be 60 kW. It is proposed to transmit performances at the Opéra Comique and the Comédie Française, lectures at the Sorbonne, and notable speeches. It was at first proposed to utilise the Eiffel Tower, but the idea was abandoned for several reasons. First, a station within Paris itself would make reception there difficult; secondly, the tower is utilised for transmitting messages in Morse; and finally, it belongs to the State, which is not prepared at present to establish a new station.

COMMERCIAL PUBLICITY DISPUTE.—*The Times* reports that there is a very interesting controversy going on just now in Paris, where the three stations, Eiffel Tower, Radio Paris, and P.T.T. derive part of their incomes from broadcast commercial publicity. The trouble at present is due to the fact that the Eiffel Tower is being severely censored for this publicity work, and the Minister of Commerce has gone so far as to commission a special censor with instructions to cut off the transmission when any broadcast is made which might be taken as publicity.

Germany.—NEW STATIONS.—The French military authorities have given permission for the erection of a wireless broadcasting station in the Palatinate. The station will be erected in a central part of the province, and the Post Office authorities expect to put it into operation within the next six months. The wave-length is not yet announced.

The new wireless station for the Rhineland, situated in Elberfeld, near Barmen, has been tested by the Postal authorities and handed over to the broadcasting society. Trials will be made forthwith, and it is hoped to have the station in full operation before Christmas.—*Reuter* (Mainz).

Hungary.—NEW BROADCASTING STATION.—Next spring the Hungarian Postal Administration intends to construct a new broadcasting station which will be much more powerful than the present station. Like the old one, it is to be erected on the island of Csepel. As a result of its construction, an increase in the number of subscribers is expected, particularly in the provincial districts. If necessary, it will be possible to raise the transmitting power of the new station to the level of the largest European stations.—*Reuter's Trade Service* (Budapest).

Prosecutions.—LICENCES AND TAXATION.—There have been 430 successful prosecutions of people for failing to take out licences, said the Assistant Postmaster-General, Lord Wolmer, in the House of Commons recently. People who have more than one receiving set are expected to take out a licence for each. Lord Wolmer said that the idea of taxing receiving sets according to the valve power, instead of the present flat rate, was a very attractive one, but there were many difficulties in the way.

"The owner next to you owns everything above his property right up to Heaven, and I am afraid you will have to take your aerial down," said Mr. Clarke Hall, at Old Street police court, London, recently, to a man who stated that a neighbour, over whose premises he had stretched an aerial, had asked him to remove it.

Sweden.—NEW BROADCASTING STATION.—It is reported that the new broadcasting station, which is being erected at Motal, will be completed by next spring. The *Daily Telegraph* states that the masts will be about 380 ft. high and the power used will be 120 kW, according to the German method of calculation. The transmission equipment is being delivered by Marconi's Wireless Telegraph Co.

BROADCASTING PICTURES.—M. Hermod Petersen, chief engineer of the Telegraph Administration, who for a number of years past has been carrying out experiments relating to the broadcasting of portraits and pictures, states that the problem has now been solved.—*Reuter* (Oslo).

Wave-length Changes.—The following statement has been issued by the British Broadcasting Co.:—"The new wave-length scheme has been in operation for over a week. Observation and experiment enable the B.B.C. engineers now to make certain proposals to the various authorities concerned for the betterment of conditions. The results of the experience of the past week induce us to recommend rather more use of the international common waves and rather less use of single waves shared by several British stations than was originally contemplated. Details of prospective adjustments will be published shortly. Listeners can be assured of steadily improving conditions. So far as the main stations are concerned, the plan has already greatly reduced interference."

RECENT CHANGES.—To obviate interference between the Aberdeen (2BD) station and that at Birmingham (5IT), the former changed its wave-length on November 25th from 491.8 to 500 metres. Birmingham retains its wave of 491.8 m. Not foreseen at the time of the international adjustment, the waves of the Bournemouth and Newcastle stations (306.1 and 312.5 m. respectively) place them very near to that used by shipping (300 m.). The position was to be reviewed at a meeting of the Bureau Internationale de Radiophonie at Geneva on December 1st.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—January 4th, 1927. P.M.G.'s Department. Bells and buzzers. (B.X. 2984.)*
January 18th, 1927. Switchboard cable. (B.X. 3013.)*
January 25th, 1927. Telephone transmitters and parts. (B.X. 3012.)*
Telephone receivers and associated parts. (B.X. 3041.)*
SYDNEY.—January 26th, 1927. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories (Spec. 1065). (A.X. 3810.)*

Ayr.—December 7th. Tramways Committee. Stores, including trolley, guard, and span wires, insulated wires, circuit breakers, &c. Forms from Mr. W. Grant, general manager.

Belfast. — December 11th. Electricity Department. Penstocks for circulating-water channels and ducts at Harbour power station. (November 26th.)

Belgium.—ANTWERP.—December 6th. Municipal Council. Power plugs and boxes for electric cranes; also 12 section boxes. (B.X. 3052.)*
December 8th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 17,887 metres of telephone cable and one lot of 3,535 metres. Particulars (Cahier des Charges, Special No. 3-232) for 4 fr. 60 cents.

Cleethorpes.—December 11th. Electricity Department. E.h.p. feeder and l.p. distributor cables, section pillars, and disconnecting boxes, transformers and switchgear equipment, and house services, including meters. (November 19th.)

Dublin.—December 9th. Great Southern Railway Co. Six months' supply of electric cables, electric lamps, &c. Forms of tender (6d. each) from the Stores Superintendent, G.S. Railways, Inchicore, Dublin.
December 14th. Commissioner of Public Works. Installation of electric lighting at the new military barracks, Limerick. Specifications (£1) from the Office of Public Works, Dublin.
December 7th. Dublin Port and Docks Board. Twelve months' electrical supplies. Forms of tender from Mr. E. H. Bailey, secretary, Ports and Docks Office, Westmoreland Street, Dublin.

Haddington.—December 11th. East Lothian Education Authority. Electric lighting of new infants' school at Tranent. Schedules from Messrs. R. & A. K. Smith, 44, Queen Street, Edinburgh.

India.—December 21st. India Store Department. 280 miles (approx.) 110,000-V overhead transmission line. (October 29th.)
Janaury 4th, 1927. 264,650 (approx.) copper bonds for track rails. (November 26th.)
December 7th. Madras and Scuthern Mahratta Railway Co., Ltd. Sixteen 35-b.h.p. short-circuited rotor motors and two 10-b.h.p. ditto, complete with pulleys, slide rails, starting switches, &c. (November 19th.)
December 14th. 200,000 large double-shed porcelain insulators, 50,000 large pothead ditto; 5,000 yd. 40-wire armoured composite cable. (See this issue.)

Lasswade.—Electric lighting plant at Hawthornden Castle, Lasswade, for Sir James Williams-Drummond, Bart. Particulars from Mr. Stewart Kaye, A.R.I.B.A., architect, 14, Hill Street, Edinburgh.

London.—LAMBETH.—December 7th. Board of Guardians. Twelve months' supply of incandescent electric lamps. (November 26th.)
LONDON COUNTY COUNCIL.—December 13th. Electrical installation at the Lomond Grove Elementary School, Camberwell, S.E. (approx. 122 wiring points). (See this issue.)

Manchester.—December 14th. Tramways Committee. Steel girder tramway rails. Specification and form, Mr. H. Mattinson, General Manager, 55, Piccadilly, Manchester.
January 3rd, 1927. Electricity Committee. 33,000-V, 420-V, and 240-V switchgear. (November 26th.)

Meltham (near Huddersfield).—December 31st. Wiring, fittings, &c., required in the electric lighting of the Parish Church. Particulars from Mr. W. R. Carter, secretary, Church Council, Birchfield, Meltham.

New Zealand.—WELLINGTON.—January 4th, 1927. Public Works Department. Waikaremoana electric power scheme. Switchgear and transformers. (B.X. 2872.)* January 18th, 1927. Transmission line steel towers. (A.X. 3732.)* February 1st, 1927. Storage battery and booster. (B.X. 2937.)*
February 15th, 1927. Transformers for Waikato. (B.X. 2985.)*
Post and Telegraph Department. January 17th, 1927. Switchgear, cables, motor-generator sets, &c. (B.X. 3020.)*
January 19th, 1927. Electric bells and tumbler switches. (B.X. 3011.)*
January 31st, 1927. Government Railways. Electrical equipment for Otahuhu car and wagon workshops. (B.X. 3038.)*

Nottingham.—December 31st. Electricity Department. Two 30-in. electrically-driven pumps, one motor-driven twin booster, one 256-cell storage battery. (November 19th.)

Oxford.—December 8th. Oxford Electric Co., Ltd. One 7,500-kW turbo-alternator, with condensing plant and auxiliaries. (November 19th.)

Portsmouth.—Electricity Department. Two 50,000-lb. per-hour water-tube boilers, with economisers, steel bunker and steel building. (November 26th.)
December 8th. Board of Guardians. Three months' supply of electrical stores and lamps. Particulars from the Guardians' Offices, St. Michael's Road, Portsmouth.

Prestatyn.—December 6th. Urban District Council. Underground cables, overhead lines, transformers, e.h.p. and l.p. switchgear, and sub-station equipment. (November 12th.)

Rochdale.—December 8th. Town Council. Electric lighting and power installation at 238 houses, Dicken Green housing estate. Particulars from Borough Surveyor, Town Hall.

Siam.—December 15th. Royal Siamese Post and Telegraph Department. Telephone and submarine cable. (B.X. 3026.)*

South Africa.—KEETMANSTROOP.—December 15th. Municipal Council. Material required for an electric lighting scheme. (B.X. 3007.)*
JOHANNESBURG.—December 11th. Municipal Council. H.p. cable. (B.X. 3017.)*
CAPE TOWN.—December 15th. Electricity Department. Oil-cooled transformers. (B.X. 3028.)*
December 30th. South African Railways. Switchgear, cables, and transformers. B.X. 3040.)*

Sutton Coldfield.—December 14th. Electricity Department. One 1,000-kW steam turbine, with condensing plant, auxiliaries, and piping. (November 12th.)

Tralee (County Kerry).—Kerry County Council. Wiring installation for the new County Hall, Tralee, County Kerry; and two 6-kW, 220-V, d.c. generators, direct-coupled to heavy-oil engines; supply and erection of one storage battery of 126 cells of about 110-Ah capacity; supply and erection, and alternatively for supply and delivery only, of one four-panelled switchboard. Messrs. McEntee & O'Kelly, consulting engineers, Dublin.

Uruguay.—MONTEVIDEO.—January 19th, 1927. State Electricity Supply Works. 100,500 metres of wires and cables. (B.X. 3042.)*
January 24th, 1927. L.p. cables, telephone cables, branch and terminal boxes. (B.X. 3064.)*
January 28th. 923,000 meters, outdoor wires and cables. (B.X. 3063.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belgium.—Belgian Post and Telegraph Department.—Accepted:—
Manufacture and laying of underground dry core telephone cables between Brussels and Luxembourg, a distance of 89 kilometres, and between Brussels, Charleroi and Mons, a distance of 89 kilometres (the contract price is approximately £450,000).—Ateliers de Constructions Electriques de Charleroi.

Croydon.—Electricity Committee. Recommended:—
Two 50,000-lb. water-tube boilers (£33,888).—Messrs. Babcock & Wilcox, Ltd.

Dundee.—It was stated at a meeting of the Corporation Electricity Committee that the cheapest offer for a certain type of cable was £578 for Dutch manufacture, while the cheapest British offer was £721. In regard to other types, the lowest offer was £379 (German), and the cheapest British quotation was £552. It was agreed to accept the lowest tender, subject to the cable being satisfactory.

Glasgow.—Tramway Committee. Recommended:—
Block tin.—P. & W. McLellan, Ltd.
Chain-grate links for Pinkston, and new drum for boiler.—Babcock and Wilcox, Ltd.
Armature coils.—Manchester Armature Repair Co., Ltd.

Grimsby.—Electricity Committee. Accepted:—
Electric motor at hospital laundry (£135).—M. Jennison, Ltd.

Halifax.—Markets and Parks Committee. Accepted:—
Overhead transit equipment at new abattoirs (£3,643).—J. & F. Howard, Ltd.

High Wycombe.—Town Council. Accepted:—
Cable for street lighting (£138).—Electric Light Co.

Hull.—Works Committee:—
Electric light installation at depôt workshops (£438).—A. Shaw (accepted). (City Engineer's estimate, £468.)
Electricity Committee.
20-ton overhead travelling crane (£1,620).—John Smith (Keighley), Ltd. (accepted). The quotations varied from £1,601 to £2,678.

Telephone Committee. Accepted:—
Automatic exchanges: Anlaby Road (£1,254), Somerset Street (£1,769).—Quibell & Son, Ltd.
Table telephones (£634).—Automatic Telephone Manufacturing Co., Ltd.
Cable (£457).—W. F. Dennis & Co.

Irish Free State.—GOVERNMENT CONTRACTS.—The undermentioned contracts were placed by the Irish Free State Government departments from September 28th to October 25th:—

COMMISSIONERS OF PUBLIC WORKS.
Clonmel Gárda Siochána station, Co. Tipperary (electric lighting).—M. F. Kent.
National Library, Dublin (electric lighting).—Gleeson O'Dea & Co., Ltd.

CONTROLLER OF STORES (POSTS AND TELEGRAPHS).
Cable (electric light).—W. F. Dennis & Co.
Cable (enamelled and cotton core).—Connolly's (Blackley), Ltd.
Cases for switchboard, magneto cordless.—T. R. Scott & Co.
Coils, repeating (telephone).—Standard Telephones and Cables, Ltd.
Conduit fittings.—Edison Swan Electric Co., Ltd.
Electric light fittings.—Siemens and English Electric Lamp Co., Ltd.; British B.A.G., Ltd.; Edison Swan Electric Co., Ltd.
Fuse mountings.—Phœnix Telephone and Electric Works, Ltd.
Insulators (telegraph).—Siemens-Schuckert (Ireland), Ltd., and Geerz Bros. and Kellie (Ireland), Ltd.
Lamps (electric light).—Sphinx Electric Supplies (Ireland), Ltd.
Receivers, bell (telephone).—Telephone Manufacturing Co., Ltd.
Sections for Q type transmitters (wireless).—Marconi (Ireland), Ltd.
—*Irish Electrician.*

Leeds.—Tramways Committee. Accepted:—
25 sets of platform gear for wheel and track brakes (£25 per set).—Maley and Taunton, Ltd.

Electricity Committee. Accepted:—
Cables.—£3,080, W. T. Henley's Telegraph Works Co., Ltd.; £5,220, Macintosh Cable Co., Ltd.; and £2,841, Greenwich Cable Works, Ltd.

Leyton.—Education Committee. Accepted:—
Installing electric light at Knotts Green Special School (£227).—A. E. Humphries.

London.—Great Western Railway Co. Accepted:—
Six 100 kVA single-phase transformers for Park Royal generating station.—Metropolitan-Vickers Electrical Co., Ltd.
Two 5-ton and two 6-ton electric cranes for Newport Docks.—Stothert and Pitt, Ltd.

Manchester.—Paving Committee. Accepted:—
Torch lamps.—Till & Whitehead, Ltd.

Tramways Committee. Accepted:—
Tramway rail bonds.—Thomas Bolton & Co., Ltd

Education Committee. Accepted:—
Electric light installation, New Morton Municipal School.—Hanchett, Barratt & Carrie.
Re-arrangement of electric lighting at Webster Street school.—A. E. Sudlow & Co.

Electricity Committee. Accepted:—
Weldless steel spigot and lancet tubes.—Browford Tube Co., Ltd.
Weldless steel lamp columns and fittings.—British Mannesmann Tube Co., Ltd.
One 100-ton electrically operated turbine house crane.—Clyde Crane and Engineering Co., Ltd.
One 1,250-kVA static transformer.—The Fuller Electrical Manufacturing Co., Ltd.
Two 25,000-kVA static transformers.—Metropolitan-Vickers Electrical Co., Ltd.
Steelwork, &c., Barton power station extensions.—Edward Wood & Co., Ltd.

Housing Committee. Accepted:—
Electric installation at housing estates.—W. Spreadborough, J. Armstrong and Co., Ltd., and Mr. J. V. Pyatt.

New Zealand.—The following tenders have been accepted by the Government in connection with the Waikaremoana hydro-electric scheme:—
Generators (£29,242).—Metropolitan-Vickers Electrical Co., Ltd.
Turbines (£21,686).—Armstrong, Whitworth & Co., Ltd.
Indoor control and switchgear (£5,424).—Cory, Wright & Salmon (on behalf of the English Electric Co., Ltd.).
Transformers (£15,794).—Metropolitan-Vickers Electrical Co., Ltd.—*Reuter.*

Oldham.—Electricity Committee. Accepted:—
Meters.—Measurement, Ltd.
Education Committee. Accepted:—
Electric lighting at Ascroft Technical School.—Starkie & Sparkes.

Richmond (Yorks.).—Board of Guardians. Accepted:—
Installing electric light at the Institution.—Mr. D. M. Maclean.

Salford.—Electricity Committee. Accepted:—
7,000 yd. 1.p. cable (£2,397).—W. T. Glover & Co., Ltd.
One 5,000 kVA 3-phase transformer for Agecroft power station (£2,305).—Hackbridge Electric Construction Co., Ltd.
33,000-V switchgear (£1,198).—Ferguson, Pailin, Ltd.
33,000-V feeder cubicle (£2,209).—Metropolitan-Vickers Electrical Co., Ltd.

Sheffield.—Corporation. Accepted:—
Electric wagon traverser for the Neepsend generating station (£1,044).—Ransome & Rapier.

Stirling.—Town Council. Accepted:—
Installing electric light in new houses in Broad Street, Lockhart and MacNab, and in Burnside Street, Mr. D. Henderson.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Switchgear for central power house (£10,519) and Stoke sub-works (£1,968).—Metropolitan-Vickers Electrical Co., Ltd. At Marsh Street sub-station (£432).—A. Reyrolle & Co., Ltd.
Coal and ash-handling plant at central power house (£16,506).—W. J. Jenkins & Co., Ltd.
Neutral earth resistance for generator (£84).—Metropolitan-Vickers Electrical Co., Ltd.
Wiring and fitting eight all-electric houses at Hanley (£262).—Hawley and Ingram.

Waterford.—The contract for the electric lighting installation of the Waterford Dressed Meat Factory has been placed with Messrs. Kealing & Gaule, of Waterford.

Forthcoming Events.

Electrical Power Engineers' Association (Southern Division).—Friday, December 3rd. Institution of Electrical Engineers, London. 7 p.m. "Choice of Turbine Plant." Mr. C. H. Naylor.

(West Yorks. Section).—Saturday, December 4th. Hotel Metropole, Leeds. Annual dinner.

Junior Institution of Engineers.—Friday, December 3rd. Royal Society of Arts. 7.30 p.m. Presentation of medals and awards by Mr. J. S. Highfield, and inaugural address by the President, Engineer Vice-Admiral Sir R. B. Dixon.
Friday, December 10th. 39, Victoria Street, S.W. 7.30 p.m. "The Determination of Temperature in Cylinders of Internal-Combustion Engines." Mr. G. E. Foster.

Salford Technical and Engineering Association.—Saturday, December 4th. Royal Technical College. 7 p.m. Annual meeting.

Royal Institution.—Saturday, December 4th. 3 p.m. "Atmospheric Electricity." Mr. G. C. Simpson.
Tuesday, December 7th. 5.15 p.m. "The Imperfect Crystallisation of Common Things." Sir William Bragg.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, December 4th. South Wales Institute of Engineers, Cardiff. 6 p.m. "General Colliery Engineering." Mr. W. G. Hardie.

(North of England Branch).—Saturday, December 11th. Durham. "The Operation of Electrical Protective Devices." Mr. D. A. Murphy.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, December 6th. London. 7 p.m. "Notes on the Trend of Electrical Development in America and Canada." Mr. Ll. B. Atkinson.

(Scottish Centre).—Tuesday, December 7th. Glasgow. 7.30 p.m. "Home Lighting." Mr. R. B. Mitchell.

(Dundee Sub-Centre).—Thursday, December 9th. University College, Dundee. 7.30 p.m. "Tidal Power from the Tay." Prof. A. R. Fulton.

(East-Midland Sub-Centre).—Tuesday, December 7th. The College, Loughborough. 6.45 p.m. Address by Col. J. F. Lister, Chairman of the South-Midland Centre.

(London Students' Section).—Friday, December 10th. Automatic Training School, G.P.O. 6.30 p.m. "Automatic Telephony." Mr. F. I. Ray.
Tuesday, December 7th. Engineers' Club, W. 7.30 p.m. Smoking concert.

(Western Centre).—Monday, December 6th. Swansea. 6 p.m.; and Tuesday, December 7th. South Wales Institute of Engineers, Cardiff. 7 p.m. "The All-Electric House." Dr. S. Parker Smith.

(South Midland Centre—Wireless Sub-Section).—Monday, December 6th. Studio of the British Broadcasting Co., Birmingham. 7 p.m. "Distortion in Receiving Sets." Messrs. J. A. Cooper and A. C. Chatwin.

(South-Midland Students' Section).—Tuesday, December 7th. University, Birmingham. 7.15 p.m. "The Windings of Electrical Machinery." Mr. L. Greenwood.

Electric Lamp Manufacturers' Association of Great Britain.—Monday, December 6th. Lighting Service Bureau. 7.30 p.m. "Light as a Decorative Medium." Mr. P. J. Spencer.

Roentgen Society.—Tuesday, December 7th. 32, Welbeck Street, W. 8.15 p.m. Ordinary meeting.

National Association of Supervising Electricians.—Tuesday, December 7th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Cables." Mr. A. I. Tracey.

Institution of Mechanical Engineers.—Tuesday and Wednesday, December 7th and 8th. Storey's Gate, S.W. Annual meeting and inaugural dinner.

Institution of Civil Engineers.—INFORMAL MEETING.—Wednesday, December 8th. London. 6 p.m. "The Circumstances in which Small Private Electric Generating Stations may have Advantages over Public Stations." Mr. A. H. Dykes.

Institute of Wireless Technology.—Monday, December 8th. Engineers' Club, W. 7 p.m. "A New Rectifier-Amplifier for Broadcast Reception of High Quality." Mr. W. A. Chambers.

Society of Technical Engineers (Manchester Area).—Thursday, December 9th. Church Institute, Stretford. 8 p.m. "The Electricity Bill." Mr. J. W. Thomas.

Electrical Contractors' Association (Newcastle Branch).—Thursday, December 9th. Tilley's Restaurant, Newcastle. 7 p.m. Annual dinner.

Electrical Trades Benevolent Institution (North-East Coast Section).—Friday, December 10th. The Old Assembly Rooms, Newcastle. Annual ball.

Institute of Marine Engineers.—Friday, December 10th. Institution of Mechanical Engineers, London. 6 p.m. Discussion on Fifth Report of Oil Engine Trials Committee.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 10th. Newcastle-upon-Tyne. 6 p.m. "Workshop Methods in Heavy Engineering." Mr. H. I. Brackenbury.

Physical Society of London.—Friday, December 10th. Imperial College of Science, S.W. 5 p.m. Ordinary scientific meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—
GAMA electric wash boilers.
IOTA electric wash boilers.
LAZI-ARM telephone brackets.
Electrical tattooing apparatus.
Small electrically-operated sand-blasting apparatus for marking drinking glasses.

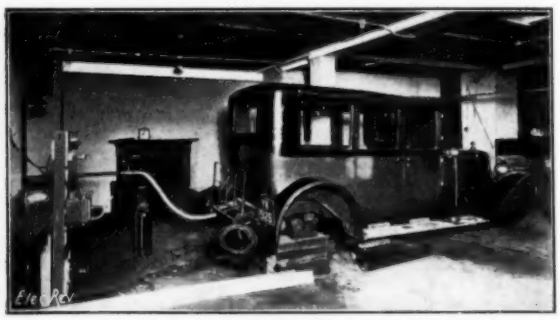
Ultra-Violet-Rays in Farming.—The South-Eastern Jersey Club visited Mr. R. Borlase Matthews's all-electric farm at East Grinstead on November 27th. Among the 67 different applications of electricity there, they were particularly interested in the new model "Hannovia" ultra-violet lamp designed for the treatment of cattle and chickens.

Notes.

The League of Nations and Electrical Problems.—A Committee formed by the League of Nations to study general electrical problems and the organisation and exploitation of hydro-electric energy, began to hold meetings at Geneva on November 17th. It is reported that the Committee will form an international centre dealing with all information referring to the use of electricity.

Appointments Vacant.—Resident engineer for electricity supply station in India (Rs. 1,000 per mensem). Mains engineer (£900) for the Manchester Corporation Electricity Department. Electrical engineer-in-chief for the Government of Nigeria (£1,100+£200 duty allowance). Three switchboard attendants, for the Ayrshire Electricity Board. Male shorthand typist (£160), for the Hastings Corporation Electricity Department. (See our advertisement pages to-day.)

A Temporary Electricity Supply.—The accompanying illustration shows an ingenious arrangement which was recently adopted by Messrs. Car Mart, Ltd., to illuminate their London showrooms during the period of restricted supplies from the public electricity mains. The car shown is an Austin twenty, which was placed in the basement of the building. The rear axle was removed and a dynamo was directly coupled



An Automobile Power Installation.

to the propeller shaft. A temporary connection was then made to the supply switchboard, as indicated in the illustration. The flexible pipe was used to carry the exhaust to the outside of the building.

Lightning Protection of Oil Tanks.—At the annual meeting of the American Petroleum Institute in Los Angeles last January, Mr. F. W. Peek, of the General Electric Co. (America), described experiments which had been made in the Pittsfield laboratory with artificial lightning and miniature oil tanks, and told how protection from direct hits by lightning can be secured. Where there are explosive mixtures the protection problem is exceedingly difficult. Just as a considerable voltage may appear on electrical transmission lines a mile or more from the lightning discharge, due to induction effects, so may sparks be caused by voltages induced in metal parts of the tank, even though the tank is not struck directly by the lightning. A spark at 500 volts, caused by a lightning stroke several miles away, could ignite the mixture. If a tank could be made completely of insulating material, there would be no spark, but there are always pipes, nails, conducting strips, &c., more or less isolated. Earthed wires strung over the tank would reduce the induced pressures, and an earthed 2-in. net cage would reduce them to about one-tenth; the hazard would be reduced, but a storm near-by could still cause a spark. The only completely safe possible method where there is explosive gas is an all-metal tank; even then, however, there is danger when projections extend from the surface. Where explosive mixtures of gases can be kept from the tank, the chance of induced voltages causing trouble is small. Direct hits, however, could set the oil-soaked roof on fire. It has been found that lightning never strikes the ground nearer a conducting rod than four times its height. If the lightning does not strike the rod, then it hits the ground some distance away. A number of rods properly placed about the tank would either take the hits or cause the lightning to strike the ground some distance away. Research has shown that a man standing is 15 times as likely to be struck as a man flat on the ground. It also showed that the edge of a small tank will always be struck, while very large tanks may be hit anywhere. The investigations also showed that explosive gases may be set off by sparks produced by means other than lightning, as, for instance, static sparks produced by friction.

Chiswick Inquiry Decision.—*The Times* reports that the Minister of Health has refused to sanction the application of the Chiswick Urban District Council for permission to amend its existing town-planning scheme to enable the London and Home Counties Joint Electricity Authority to erect a power station on 45 acres of Duke's Meadows, Chiswick, which are reserved under the town-planning scheme for playing fields and open spaces. The application was the subject of a public inquiry in October.

Large Generating Plant.—A steam turbine generator set rated at 208,000 kW, which is claimed to be nearly half as large again as any under construction anywhere in the world, is being manufactured by the General Electric Company of America at Schenectady, New York, as the first unit for the new electric generating station of the State Line Generating Company on the Lake Michigan shore, which, it is claimed, will be the largest power station in the world. The set will also incorporate the largest 1,800-r.p.m. generator unit ever constructed, it will be the first to use live steam for reheating, and also the first machine of the class to generate at 18,000 V. The State Line station is designed for a capacity of 1,000,000 kW. The plant will serve exclusively as a producer and wholesaler of electricity, and will supply energy for the interconnected power companies of the Chicago-Illinois-Indiana district. The 208,000-kW set includes one h.p. and two l.p. units so connected that the sections can be operated independently if desired. Steam is admitted to the h.p., 76,000-kW element at 600 lb., 730 deg. F., whence, at a reduced pressure and temperature, it passes to a reheater using live steam. After being raised to a temperature of 500 deg. F., it is divided and passed to the two other turbines, each rated at 66,000 kW. A 4,000-kW service generator is attached to each of the l.p. units, and in all cases the speed is 1,800 r.p.m., and the generation pressure 18,000 volts. The complete weight of the machine will be approximately 4,000,000 lb. The set will require 400,000 gal. of water per min. for cooling purposes, and two tons of coal per min. for steam generation.

Electric Hair-Cutting Machines.—Electric hair-cutting machines are rapidly coming into use in Germany, the principal types being: Machines comprising an electromotor, flexible shaft, and handpiece for the hair clipper; machines directly-coupled to the motors; and machines on the principle of the electromagnetic interrupter. Owing to the great vibration and noise made by the last two types, the first appears to provide the best solution of the problem. The most popular arrangement is probably the suspended hair-cutting machine, which is fixed on a running roller, and can pass from one chair to another over a wire rope or rail at a convenient height above the chairs. With the object of preventing the machine being in the way of the hair-dresser when out of service, a new design has recently been brought out in which a suspension block permits of the entire machine being pushed out of the way, when not required, so that the hair-dresser can work conveniently underneath it. When the machine is again wanted, it can be drawn down into the most convenient position. The handpiece for the clipper is provided with gearing which reduces the rotating speed of the motor from 5,000-7,000 r.p.m. to 750-1,000 r.p.m., and converts the rotary motion of the cutter into an alternating movement.

Power from the Sea.—A method by means of which, it is claimed, power can be obtained from the sea was described in a communication from two French scientists that was recently read before the Academie des Sciences. M. George Claude, the authority on liquid air and synthetic ammonia, and M. Boucherot propose to produce power by utilising the difference of temperature between the ever-tepid surface waters of tropical seas and the always cold submarine waters. Owing to the current flowing from the Polar seas, such a process appeared difficult, because of the comparative slightness of the disparity of temperature of about 20 deg. Nevertheless, M. Boucherot and M. Claude claim to have accomplished it by boiling the tepid surface water in vacuum. They are stated to have demonstrated to the members of the Academy with what facility steam thus produced, the pressure of which is only 0.03 that of the atmosphere, can be employed to drive steam turbines when it is drawn by the very high vacuum that can be maintained in the condenser by the cold submarine water. According to the inventors, the work accomplished by the steam derived from such surface water would be equal to the work that would be done by the same water falling from a height of 100 metres. It is added that energy could be obtained from the sea at a rate of 400,000 kW per one thousand cubic metres of hot and cold water per second, while the installations would not cost any more than in the case of the most favourable waterfalls.—*Reuter* (Paris).

The Central Electricity Board.—The *Financial News* of November 30th says:—On inquiry at the Central Unionist Offices yesterday it was learned that Sir Herbert Blain, the Chief Agent, who is to retire at the end of the year, had no knowledge of his reported appointment as chairman of the new Electricity Board under the Electricity Bill now before Parliament.

Technical Education in the Irish Free State.—At a recent sitting of the Irish Free State Technical Education Commission in Dublin evidence was given at considerable length by Mr. R. C. Ferguson, Director of the Industries Branch of the Ministry of Industry and Commerce. In the course of his evidence, Mr. Ferguson said that plans for technical training in the Irish Free State should certainly envisage the industries which were at the moment developing, or were likely to develop, within the coming years. The Shannon scheme would result in a very extended use of electricity, and this would need not only a much larger number of skilled electricians of all kinds and types in all parts of the country, but also an extended appreciation of the practical application of electrical

power in productive operations, whether in the factory, the workshop, the rural industry, or on the farm. It would be wise, therefore, that consideration should be given to widely-extended training in connection with all branches of the technical industry and in the modern applications of electricity. Mr. Ferguson declared that already there were signs that there was a shortage of highly-skilled electricians in the Free State, and that this shortage would undoubtedly become more and more acute unless steps were taken to remedy it.

The Shannon Scheme.—The survey work in connection with establishing the first ring transmission network under the Shannon hydro-electric power scheme has now been completed, and the erection of the overhead lines will shortly be commenced. The transmission lines will run from Dublin to Wexford, due west to Waterford, to Kilkenny, and from thence to Maryborough, and back to Dublin. Waterford city, it is expected, will be lighted by electricity next year. Power from the Shannon scheme will not be available until early in 1929, but an electricity supply from the Dublin station will be transmitted over the ring transmission network to Waterford, where preparations are being made for its distribution.

Educational.—A coal treatment laboratory for research of a varied kind was formally opened at Birmingham University by Viscount Chelmsford, chairman of the Central Committee of the Miners' Welfare Fund, on November 25th. The laboratory has been inaugurated to enable the Mining Department of the Birmingham University to extend its researches into that side of mining technology embracing the operations of grading, cleaning, and classifying the raw product. Funds amounting to £9,400 have been provided for the construction and equipment of the laboratory by the Miners' Welfare Fund. The equipment includes pulverised-fuel plant, with which complete data may be obtained from an exhaustive series of tests on the utilisation of powdered fuel under a boiler of modern design.

The successful work of the Birmingham Municipal Technical School was the subject of favourable comment by the Lord Mayor (Alderman A. H. James) and Mr. Gilbert Vyle (president of the Association of British Chambers of Commerce) last week at the annual prize distribution. The Principal (Dr. W. Sumpner) stated that there were over 4,000 students, and the classes numbered over 400 in the evenings and 200 in the daytime. The most satisfactory development in recent years had been the rapid growth of the part-time day classes. Students had obtained the first and second places in the national examinations in telephony, and the first place in electrical installation work; they had also been very successful in the examinations for the national certificates awarded by the Institutions of Electrical and Mechanical Engineers.

We have received a copy of the annual report, 1925-26, of the Royal Technical College, Glasgow. The total number of class enrolments for the session was 9,772, as compared with 10,787 for the previous session. The class enrolments for electrical engineering amounted to 678—205 for day and 473 for evening students. The expenditure for the year was £74,845, or £572 in excess of the revenue.

Fatality.—An inquest was held at Limerick recently on the body of Thomas Whiteside, a worker on the Shannon scheme, which was found in a field at Ardnacrusha, near the pumping station. The jury found that deceased came into contact with a broken "live" wire whilst discharging his duty, and received a fatal shock.

International Coal Conference.—The International Conference on Bituminous Coal ended its sessions at Pittsburgh U.S.A., on November 19th. Dr. R. Lessing, consulting engineer, London, dwelt on the appalling waste resulting in Britain from the burning of coal which was not cleaned. He calculated that the ash in the yearly coal production of the United Kingdom exceeded by 25,000,000 tons the output of iron ore. The cost of the railway transport of this useless material amounted to £5,000,000. Add to this the cost of the handling of the ash, disposal, and so forth, and it would be seen that the non-productive expenditure in Great Britain from the burning of coal ranged from £10,000,000 to £20,000,000. Mr. Walter E. Trent, mining and metallurgical engineer, New York, declared that the process of pulverising coal to the consistency of talcum powder, so that it became fluid when heated and ran like water, would be followed by the use of this new coal in internal-combustion engines instead of petrol. In a few weeks' time the first motor engine to be operated by oil obtained by pulverising coal would make its appearance in Kansas City. Dr. Gustav Egloff, Chicago, declared that bituminous coal deposits in the United States were sufficient to supply the world with motor fuel for 800 years. Mr. Neilson, London, told the conference that careful calculations showed that the cost of transmitting 100,000 British thermal units of gas obtained at the pit-mouth by long-distance piping would be a trifle more than 1½d. for 75 miles.

Local Societies.—"BEAM" RADIO-TELEGRAPHY.—Mr. John Lee, controller of the Central Telegraph Office, London, addressed the Birmingham Rotary Club on November 22nd, on "Aspects of Imperial Wireless Services." He said the new beam service to Canada had been very satisfactory, and at no period since the second day's working had there been total severance of communication. So far as the engineers could ascertain at the moment, it was exceedingly probable that they would shortly be able to give much more continuous working. There was every indication that the future efficiency of the services lay in a close co-ordination of the wireless link and the cable services, for one could be used to overcome the disabilities of the other. Chief amongst the disabilities of the wireless link at present was the etheric storm, which the experts were yet far from understanding, and recent experience had shown that the phenomena of Aurora Borealis influenced wireless communication in a marked degree. The Imperial services to South Africa, India, and Australia would, he added, soon be working.

PHOTO-TELEGRAPHY.—In a lecture at the Birmingham and Midland Institute recently on "Physical Effects of Light and Wireless Photography," Mr. T. Thorne Baker suggested that the time was not far distant when it would be possible to see by ordinary telephone, and a service of pictures would be broadcast to supplement the present broadcasting of speech and music.

Extra-High-Pressure Aerial Lines.—CORRECTION.—In the article on this subject by Major T. Rich in our last issue the capstan-grip anchor, fig. 5, was shown in an inverted position.

St. Dunstan's.—We have received the eleventh annual report of St. Dunstan's. This again records wonderful work on behalf of the sightless, helping them to overcome their sad handicap, and take their places beside their more fortunate fellows as useful citizens. It is very satisfactory to note that the accounts show a balance on the right side, but it is not big enough to permit of any slackening on the part of donors. An inset illustrates examples of the beautiful work carried out by blind persons, all very reasonably priced.

E.A.W. Activities.—As anticipated in our last issue, the fourth branch of the Electrical Association for Women was established on November 25th at Cheltenham at a meeting presided over by the Mayoress of the Borough, Mrs. C. H. Margrett. Miss Haslett, Director, E.A.W., addressed the meeting, and outlined the origin and objects of the Association. Miss Jeans, of the Women's Engineering Society, referred to the work of that body in promoting engineering as a career for women, and the meeting closed with a vote of thanks to the Mayoress, proposed by Mr. W. J. Bache, the Borough Electrical Engineer.

At a meeting under the auspices of the Association, held at Moseley, Birmingham, recently, Lady Brooks, the president, intimated that the Association, which had secured a large membership in the Midlands since its formation during the last British Industries Fair, proposed to hold a conference in Birmingham in the spring. During the meeting Miss Griff, chairman of the Women's Engineering Society, gave a lecture entitled "Electricity: The Domestic Magician," and demonstrations of electric cooking and sewing were given by representatives of the Birmingham Electricity Supply Department.

Lady Cowan, vice-president, London Executive, was the principal speaker on Monday last at the first annual luncheon of the Glasgow and District Branch of the Association. Miss Haslett, director, and Mr. W. T. Winning, chairman of the Scottish Centre of the I.E.E., also spoke.

On November 25th 58 members of the E.A.W. visited the showrooms of the Birmingham branch of the General Electric Co., Ltd., where a selection of artistic electric-light fittings was exhibited. An interesting talk on "Colour Lighting" was given by Mr. Unwin. A mining signalling system was also shown in operation, and after tea a vote of thanks, proposed by Lady Brooks and seconded by Mrs. Chattock, was accorded to the General Electric Co.'s staff.

The Electricity (Supply) Bill.—The House of Lords on Tuesday last went into Committee on the Bill, and sat until after 1 a.m. on Wednesday. Some minor amendments were made, and the Committee stage was completed. Amongst the amendments accepted by the Government were one to include agriculture amongst the interests to be consulted by the Minister of Transport before appointing the Central Electricity Board; and one empowering the Board to accept proposals for the delegation of some of the powers and duties of the Board within an area to an association of owners of selected stations in that area.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETINGS SECTION.—At the informal meeting on Monday, November 22nd, Mr. M. Whitgift was in the chair when Mr. J. F. Shipley opened a discussion on "Electrical Progress in European Countries." He said that in his opinion Switzerland was the country that had most rapidly developed—owing partly to its geographical position, partly to its economic necessity, and greatly to the thriftiness of a population gifted beyond measure in getting value for money. At the recent exhibition in Basle it was shown that in 1914 less than 60 per cent. of the houses in the chief cities were electrified, while in 1925 the proportion had reached 98 per cent. and the average for the whole country 95 per cent. Of all industrial enterprises 91 per cent. was electrically driven. A great programme of railway electrification was in

hand, and 64 per cent. of the total length of lines would be electric by 1928. In Basle one family in ten used electric water-heating, and there were 3,535 heaters installed in the area. In Austria it was necessary to restrict imports and develop exports; for this reason numerous large water-power stations were erected, a big programme of railway electrification was put in hand, and a large amount of electrical energy was exported to Germany. Germany's progress was astounding. Our troubles had been Germany's opportunity for a wonderful recovery, in which the electrical industry had taken a leading part; the coal fields and water power had been greatly exploited, but it was in the use of the huge lignite deposits that the greatest increases were shown. Germany was now covered with a network of transmission lines, and some of the supply companies transmitted power over a 300-mile range. Practically the whole of Germany had standardised voltages. A large Kaplan turbine installation in Sweden was described, and a large water-power plant for erection in Russia. A brief reference was also made to Finland, where the available water power is having attention. Mr. Theodore Stevens gave a graphic account of the Irish Free State project and the problem of the disposal of the enormous reserve of electricity the plant would eventually generate, and many others took part in the discussion.

Diesel Engine Users' Association.—At the meeting of the Association, held on November 26th, an interesting paper was presented by Mr. R. L. Quertier, entitled "Modern Air-Compressor Practice in Oil-Engine Installations." The author gave a considerable amount of detailed useful information regarding the principle and construction of the air compressors made by the leading British manufacturers, and dealt at some length with the latest development of the quadruplex compressor made by Messrs. Reavell & Co. There appeared to be a great divergence of opinion among Diesel-engine makers regarding the relative size of the air compressor, as compared with the engine. He had always felt that the makers had insisted on rather a large output in order to make allowance for losses in efficiency as the parts became worn and to give the excess capacity necessary to charge the starting bottles while the engine was running. The three-stage machine, with its comparatively high mechanical efficiency and small valve loss, was the best machine in spite of the fact that its thermal and volumetric efficiency was slightly lower than that of a four-stage machine. It would never be possible to arrive at what might be called a standard design.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Professor Dr. G. HERTZ, to whom has been awarded the Nobel prize for physics of 1925 (together with Prof. Dr. J. FRANCK), is a nephew of the scientist of the same name who, by discovering the propagation of the so-called Hertzian waves, laid the foundation of modern wireless communication. He collaborated with Prof. Franck at the Berlin University in experimental research into the conduction of electricity through gases, leading to very important results. This explains why the Nobel prize has been awarded to both men. In 1921 Dr. Hertz entered the physical laboratory of the Philips Lamp Works as a research physicist; *inter alia*, he did valuable work in the field of dull-emitter radio valves. Exactly a year ago Dr. Hertz accepted the chair of physics at the University of Halle (Germany).

On Saturday, November 20th, the Hackney Electricity Committee dined at the Engineers' Club to celebrate the 25th birthday of the undertaking. The Mayor presented Mr. L. L. ROBINSON, the borough electrical engineer, with a silver cigarette box to mark the occasion. The toast, "The Chief and his Staff," was given by the Mayor. Mr. Robinson's connection with the Hackney undertaking has covered the entire quarter of a century.

A settee and two easy chairs were presented to Mr. T. J. DALBY by the staff of the Hackney electricity undertaking to mark his retirement from the position of works superintendent of Millfields Road generating station, after 25 years' service. Mr. L. L. Robinson presided, and Mr. Osborne made the presentation.

Mr. R. B. MACCALL, secretary and treasurer, Glasgow Corporation electricity department, has been appointed a Justice of the Peace for the City of Glasgow.

With further reference to the resignation of Mr. JAMES DALRYMPLE, reported here last week, in consequence of the recommendation of the Glasgow Tramways Committee for the reinstatement of the men dismissed after the General Strike, when the matter came before the Corporation meeting last week that recommendation was rejected by 59 votes to 51. As the Moderates immediately carried the adjournment of the meeting by 60 votes to 47, the question of Mr. Dalrymple's resignation was not reached. In a letter which was read earlier in the meeting, Mr. Dalrymple reaffirmed his offer to resign. He said that the recommendation of the Committee left him no alternative, as he considered that his decision regarding the employés was the right one in the interests of his Department. In addition, other proposals were expected to come forward shortly which would make it very difficult for him to carry on his duties with satisfaction to himself. The Corporation's action in rejecting the Committee's recommendation must, of course, be regarded as a vote of confidence in Mr. Dalrymple.

It is reported that on Monday last the Tramways Committee agreed to accept Mr. Dalrymple's resignation as from December 31st, and remitted it to the Superannuation Committee to arrange his retiring allowance. In his letter to the Committee Mr. Dalrymple asked to be relieved of his duties at December 31st next. A sub-committee has been appointed to consider the appointment of his successor. It is understood that Mr. Dalrymple will receive a retiring allowance of between £800 to £850 per annum.

Mr. N. C. DAVIES, of the English Electric Co., Ltd., and Mr. E. P. HORT, of the Reading Corporation Tramways Department, have been appointed junior engineers at the Portsmouth Corporation generating station.

At the Middlesbrough Corporation electricity works on November 26th Mr. R. H. Scotson, the borough electrical engineer, on behalf of the staff, presented a bureau to Mr. BERTRAM SMITH, who, after being a member of the electricity works staff for 18 years, has just obtained an appointment as representative of the Macintosh Cable Co., Ltd. Mr. Scotson eulogised the services of Mr. Smith and wished him success. Mr. G. H. Moss (mains superintendent), Mr. J. Shaw (mechanical superintendent), and Mr. D. Middleton (office staff) all spoke of the high regard in which Mr. Smith is held.

Major G. FETHERSTON, D.S.O., M.C., Trade Commissioner at Cape Town, is on an official visit to this country until December 18th. Interviews can be arranged by communication with the Comptroller-General of the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Ref. No. 5,133/1.)

The marriage took place at Ashton-in-Makerfield on November 18th of Mr. J. C. WARD, electrical engineer to Messrs. H. H. Timberlake, of Wigan, and Miss M. E. PARDEY.

Mr. J. J. MACQUEEN, who has been inspector at the Leafield wireless station since its opening in 1921, has been appointed to a position at the new wireless "beam" station near Grimsby, and the staff have presented him with an oak mantel clock.

Mr. J. D. BARRON has been appointed chief assistant engineer to the Boston and District Electric Supply Co., Ltd.

On Friday last the President of the Manchester Association of Engineers, Sir BENJAMIN LONGBOTTOM, and Lady LONGBOTTOM entertained some 400 members and ladies to a conversazione at the City Art Gallery. The proceedings included a vocal and musical programme.

Obituary.—We are sure that his many friends in the electrical industry will desire to associate themselves with us in expressing deep sympathy with Mr. A. H. WALTON, M.Inst.C.E., in the further sad loss that he has sustained through the death of his eldest daughter, which occurred at 92, Queen's Road, Brownswood Park, London, N., on Friday last.

MR. W. P. ELLIOTT.—The death occurred at Rostrevor, County Down, last week of Mr. W. P. Elliott, who for upwards of four years past was manager of the municipal electricity works at Portrush.

MR. A. LEWIS.—We regret to record the death, which took place very suddenly on the morning of November 28th, of Councillor Alfred Lewis, who had been chairman of the Kettering Urban District Council Electricity Committee for nearly 20 years.

MR. C. A. HUNT.—The death occurred on November 17th, at his residence at Hampstead, of Mr. C. A. Hunt, director of the Manx Electric Railway Co., Ltd. He had been identified with the company almost from its inception, as secretary.

MR. F. T. STOKES.—We learn that Mr. Frank Torrens Stokes, chief assistant engineer to the Gas and Electric Supply Department of the Johannesburg Municipality, passed away on October 29th, following a serious operation at the Johannesburg General Hospital. He had been in the service of the Municipality for 25 years, and was a member of the Institution of Mechanical Engineers. Mr. Stokes was 54 years of age.

MR. J. GILBERT.—The death took place on November 21st of Mr. James Gilbert, aged 55, of Northwich, assistant manager of the Mid-Cheshire Electricity Supply Co.

MR. E. C. WALLIS.—The *Leeds Mercury* records the death, which took place last week, of Mr. Edwin Cooper Wallis, who had been in business as an electrical engineer in Leeds, and was a founder and president of the Electrical Contractors' Association in the year 1908-9.

New Companies Registered.

Electracts, Ltd. (217,688).—Private company. Registered November 22nd. Capital, £1,000 in £1 shares. Objects: To acquire the business of a consulting and contracting electrical engineer carried on by W. T. F. Andrews at 10, Spring Street, Paddington, W.2, as "Henderson and Lawson," and to carry on the business of electricians, electrical and motor engineers, manufacturers of telephones and telephonic apparatus, &c. The permanent directors are:—Capt. W. T. Fellowes Andrews, The High Wood, White Hill, Marlow; E. R. Hind, 24, Priory Mansions, Drayton Gardens, South Kensington, S.W. Qualification, £100. Remuneration as fixed by the board. Solicitors: W. H. Lane & Co., 27, Chancery Lane, W.C. Registered office: 10, Spring Street, Paddington, W.2.

Metropolitan Electrical Contractors, Ltd. (217,707).—Private company. Registered November 23rd. Capital, £200 in 300 10 per cent. cumulative preference shares of 10s. and 500 ordinary shares of 2s. each. To carry on business as electrical and general contractors, traders in electrical goods and machinery, &c. The first directors are:—C. R. Watson, 8, Sherwood Road, Wimbledon, S.W.19, accountant; L. P. Guilar, 32, Middleton Square, E.C.1, engineer. Qualification, 10 shares. Secretary: C. R. Watson. Registered office: 83, Tottenham Court Road, W.1.

Radiant Panel Warming Co., Ltd. (217,684).—Private company. Registered November 22nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of heating, ventilating, electrical, lighting, power, hydraulic, water supply, domestic, mechanical and general engineers, &c. The directors are:—F. A. Norris (permanent director and chairman), "Beechgrove," Sydenham Hill, S.E.26, engineer; H. A. Gadsdon, 55, Sydenham Hill, S.E.26, engineer. Remuneration as fixed by the company.

Brittain's Electric Motor Co., Ltd. (217,636).—Registered November 20th. Capital, £100 in £1 shares. Objects: To carry on the business of alternating-current motor manufacturers, mechanical engineers, general, electrical and mechanical merchants and factors, &c. The subscribers (each with one share) are:—P. B. Britain, 4a, Shorncliffe Road, Folkestone, engineer; S. G. Brittain, The Cottage, Willingale, near Ongar, stockbroker; H. N. Duke, 3, Throgmorton Avenue, E.C., stockbroker; W. H. G. Catherall, 44, Sidney Avenue, Palmers Green, N.13, advertising contractor; Dorothy W. Hinton, Woodland Avenue, Hornchurch, clerk; A. C. Everitt, 72, Wilberforce Road, Finsbury Park, N.4, clerk; Marjorie V. Baron, 9, Queen Victoria Street, E.C., articled clerk. Registered without articles of association. Solicitors: Herbert Brown & Co., 9, Queen Victoria Street, E.C. Registered office: 110, Cannon Street, E.C.

Stuart Laird, Ltd. (217,775).—Private company. Registered November 26th. Capital, £1,000 in £1 shares (100 ordinary and 900 7 per cent. cumulative preference). Objects:—To carry on the business of general dealers in, agents for, and importers, exporters and manufacturers of electric equipment, plant, machinery and motors, &c. The first directors are:—S. A. Laird, 150, Lauderdale Mansions, Maida Vale, W.1, electrical engineer; E. H. Flower, C.E., 49, Beaconsfield Villas, Brighton. Qualification, 20 shares. Registered office: 8a and 9, Great Chapel Street, Oxford Street, W.

Langdon-Davies Motor Co., Ltd. (217,637).—Registered November 20th. Capital, £100 in £1 shares. The objects, subscribers, and all other particulars are the same as for Brittain's Electric Motor Co., Ltd., above.

Official Returns of Electrical Companies.

Gordon England, Ltd.—Debenture dated October 27th, 1926, to secure £9,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. B. Silver, Wyldes Close Corner, Hampstead, N.W.

Perak River Hydro-Electric Power Co., Ltd.—Particulars have been filed of £1,350,000 7 per cent. participating debenture stock and premium of 5 per cent. authorised by resolution of July 26th, and covered by trust deed dated November 12th, 1926, constituting a specific charge on the concession granted to the company by the Government of Perak, dated November 5th, and all licences, easements, rights and advantages thereunder, and all lands and real and immovable property of the company, and all fixed plant and machinery thereon, and a floating charge on the company's undertaking and property, present and future, including uncalled capital (subject to charge securing £1,250,000 5 per cent. guaranteed debenture stock), the whole amount being now issued. Trustees: The Trustees Corporation, Ltd.

Northampton Electric Light and Power Co., Ltd.—Particulars filed of £286,000 debenture stock (inclusive of £200,000 already registered) authorised by resolutions of March 11th, 1924, and October 21st, 1926, and covered by trust deeds dated June 2nd, 1924, and November 5th, 1926, the amount of the present issue being £86,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and ranking *pari passu* with the charge created by the original trust deed. Trustees: T. W. Thornton, Brockhall, Northants, and others.

Cleartron Radio, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated October 25th, 1926, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Attaix, Ltd.—Mortgage on freehold premises, No. 106, High Street, Southampton, with fixtures, &c., dated November 3rd, 1926, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd.

Simon Bros. (Engineers), Ltd.—Satisfaction in full on November 5th of charge dated September 1st, 1926, securing £500.

Wortex Manufacturing Co., Ltd.—Satisfaction in full on November 13th, of first mortgage debenture dated June 30th, 1926, securing £1,000.

City of London Electric Lighting Co., Ltd.—A trust deed dated November 19th, 1926, to secure £600,000 consolidated debenture stock, charged on the company's undertaking and property, present and future, except uncalled capital, has been registered. The trustees are:—The Electric and General Investment Co., Ltd., Falcon House, Aldersgate Street, E.C.1. (£220,000 sold at 2 per cent. discount and 1 per cent. commission.)

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The annual meeting was held on November 25th, Mr. C. H. Gray, chairman and managing director, presiding. In proposing the adoption of the report (*vide* ELECTRICAL REVIEW, November 19th, p. 846), the chairman said it was a matter for satisfaction that the gross trading profit was only 3 per cent. less than that of the previous year, and that the net profit only fell short by a narrow margin of that earned in 1925. Discussing the accounts, he pointed out that it was proposed to transfer £35,000 to the reserve, increasing that fund to £315,000. On the whole, the directors were not displeased with the result of the year's trading, considering the difficulties and dislocation of trade caused by the coal dispute, to which was added the strike at Silvertown arising out of the general strike, which lasted for one week. Owing to the restrictions placed by the Government upon the use of English coal, they were compelled to buy Westphalian coal at a high price in order to carry on, and, finally, owing to a deterioration in the quality of the German coal, they were forced to fit their boilers for oil fuel, with which they were at present working. It was not difficult to appreciate, under those circumstances, the effect on Silvertown's trading during the latter half of the year, and the board had nothing but praise for the way the staff tackled the abnormal conditions, and pulled through successfully. He hoped that the Government would take steps to get rid of the evils arising out of the so-called "peaceful-persuasion" clause in the Trades Union Act, 1913. With reference to the Burton works, they were glad to report that the result of the year's trading showed an improvement (though a small one) over the past year, and they hoped that the steps which they had taken in the matter of accountancy would enable Burton to deal more successfully with the increasing business which was in sight. In connection with their French business at Persan, they were able to report a slight improvement in the year's trading, which result, considering the difficulties in dealing with the fluctuating value of the franc, was fairly satisfactory, and should the franc become stabilised in value, they would expect, in the future, to show a better result. Trading in France at present was most difficult owing to the continual variation in the value of the franc. In the tire business there was a distinct improvement in sales and a considerable saving in selling costs. There had been a slight falling off in their submarine cable work, but, generally speaking, there were indications of improvement in the business of that department. As to the coal stoppage, they would be better able to realise the extent of the damage done to industry in a month or two, when the air was clear, but even then it would be difficult, if not impossible, to calculate the immense loss the country had suffered. With reference to the fluctuations in the French rate of exchange, their French management had dealt successfully with that difficulty during the past year, and he had no doubt they would apply the same ability during the present trading year. Whether or not France proposed to stabilise or re-valorise the franc was not quite clear, even supposing that the re-valorisation was within her power; but as a trading concern in France, buying, manufacturing and selling, they hoped that whichever of those operations she decided to adopt, it would be done gradually and steadily in the desired direction. In conclusion, the chairman said that they could not accurately foretell the difficulties they might have in front of them, but the board felt, should difficulties arise, that they had a staff in all departments who would apply themselves to the overcoming of those difficulties.—Col. A. W. Jarvis, C.M.G., seconded the motion, which was carried after a short discussion.

Western Telegraph Co., Ltd.

The annual meeting was held on November 25th. Sir J. Denison-Pender, G.B.E., K.C.M.G. (chairman), presided. In the course of his speech the chairman said that throughout the year their cable service between South America and the rest of the world had been well maintained, and there was a net gain of £55,614 for the working year. They were thus again able to add the sum of £250,000 to the general reserve, to pay the quarterly dividend of 2½ per cent. free of tax, and to carry forward close upon £330,000, against £300,500 last year.

During the year under review their two cable ships were altogether some 250 days at sea occupied in repairs to various sections. The number of interruptions which occurred over this vast area amounted in all to 36, the majority of them of short duration. The Italian Cable Company had extended its connections on the coast up to Rosario de Santa Fé, Argentina, and Sao Paulo, Brazil, and the company's present accounts showed the effect of 9½ months' competition. The Italian Company received a large yearly subsidy from the Italian Government, and to no small extent could control the South American outward traffic from Italy, but the homeward Italian traffic was a more open market and they were not dissatisfied with their share. The All-America Cables Incorporated, following the universal road of improvement, had increased its cable capacity between North America and the West Coast of South America, but the competition between that company and themselves had latterly been carried on in a proper manner, each doing its best to give the public an efficient service, and thereby promoting cable traffic in general, and not indulging in any cut-throat policy. The Compañia Radiotelegrafica Argentina Transradio Internacional had made some headway during the year, no doubt largely due to its lower tariffs and cheaper class of telegrams. Yet another wireless competitor opened in Brazil in May last, known as the Companhia Radiotelegraphica Brazileira, with a transmitting station close to Rio de Janeiro; this also worked at lower rates than the company's. The period of operation during the year under review was only seven weeks. Since the end of June it had obtained a small amount of business.

While radio-telegraphy was offering the public an additional means of communication, still the vast web of cables which covered the world was continually increasing. Within the last 12 months over 16,000 miles of deep sea cable had been

constructed, and laid, or were about to be laid by various companies. An innovation would be made shortly by the introduction of a specially cheap rate telegram at Christmas and the New Year. In view of the number of telegraph companies competing in South America, the traffic there when trade was bad was not sufficient to go all round and give a satisfactory return to the shareholders of all the competing companies. From July to the end of October they experienced a small decrease in revenue. On the settlement of the coal dispute the depressed energies of trade would be relieved, and once more allow manufacturers and traders to resume telegraphic activities.

The report was adopted, and the appointment of Vice-Admiral H. W. Grant, C.B., to the board was confirmed.

The directors have declared the first quarterly interim dividend of 5s. per share, free of tax, being at the rate of 10 per cent. per annum.

New Issues.

Cornwall Power Co., Ltd.—On Wednesday last, this company, which was formed in June this year, made an issue of 150,000 7 per cent. convertible preference shares of £1 each. The proceeds are to be devoted to the purchase of ordinary shares of the Cornwall Electric Power Co. The company has an agreement with the Urban Electric Supply Co., Ltd., by which the latter undertakes to sell to the Power Co. its holding of ordinary shares in the Cornwall Electric Power Co.

Lancashire Electric Light and Power Co., Ltd.—The holders of this company's 7 per cent. cumulative participating preference shares have been notified of the issue of 250,000 more of these shares. The proceeds will be used for the repayment of loans in connection with the development of the company's system. The offer is also open to ordinary shareholders, and the closing date for applications is to-morrow (Saturday).

London Power Co., Ltd.—This company (formerly the London Electricity Joint Committee (1920), Ltd.), which represents the ten companies affected by the London Electricity (No. 2) Act, 1925, on Friday last advertised an issue of £4,000,000 of 5 per cent. redeemable debenture stock at 95 per cent. The prospectus stated that the final arrangements in connection with the taking over by the company of the various properties of its constituents had been practically completed, and the proceeds of the issue were required to provide for the completion of those arrangements; the extension of certain of the existing generating stations and main transmission lines; to pay off certain obligations of some of the constituent companies; and for general purposes. The obligations referred to were set out in a table included in the prospectus. The list was closed at noon on Monday last.

London Electric Supply Corporation, Ltd.

An extraordinary meeting was held on November 24th to consider resolutions for the rearrangement of the company's capital. Mr. O. R. H. Bury (who presided in the absence of the chairman, Mr. R. H. Benson) explained the provisions of the London Electricity (No. 2) Act, 1925. That Act, he said, permitted the payment of a dividend of 10 per cent. upon the capital as it was at December 31st, 1922, until 1931, when the rate fell to 7 per cent. The company could also pay 7 per cent. on any free reserves which were capitalised. The resolutions before the meeting empowered the directors to capitalise any part of the undivided profits and issue them to the ordinary shareholders in the form of shares; and provided for the subdivision of unissued £5 shares into five shares of £1 each. The chairman pointed out that the amount of the undivided profits had not yet been settled. The resolutions were unanimously adopted. In concluding the proceedings Mr. Bury said that the completion of the 1926 accounts would probably be delayed owing to certain adjustments which had to be made.

Venezuela Telephone and Electrical Appliances Co., Ltd.

The report for the year ended June 30th last records a profit of £26,516. After charging income tax and debenture and loan interest there remains £24,116. A dividend of 8 per cent. is recommended on the old ordinary shares, and it is proposed to transfer £1,500 to first debenture sinking fund, to write £1,407 off against duty on increased capital, and to place £10,000 to depreciation and renewals reserve, leaving £2,249 to be carried to undivided profits account. The directors have ordered 1,000 automatic telephone sets with the necessary equipment for Caracas; this is the first step in the ultimate conversion of the whole system. Since the close of the year the capital has been increased by the issue of 33,091 preference shares and 33,091 ordinary shares of £1 each. Out of the proceeds the loans standing in the balance sheet have been repaid. The report makes reference to the abandonment of the proposed sale of the undertaking to Venezuelan interests and states that the chairman will deal with the matter at the general meeting on December 7th.

Cape Electric Tramways, Ltd.

Mr. L. Breitmeyer (chairman) presided at the annual meeting on November 24th, and in presenting the report and accounts (*vide* ELEC. REV., November 19th, p. 846) said that during the year a heavy track-relaying programme had been undertaken in Cape Town; £16,000 had been taken from reserve for the purpose, but the revenue had to bear a further charge of £13,000. Wages had been higher, but now there was a five-year agreement between the company and its employés for the fixing of wages, with the right of revision in the event of a serious fall in revenue. They had to meet motor-'bus competition, and the necessary expenditure had been charged in the accounts. The profit was, however, only £8,085 lower than in the previous year. As stated in the report, the company had decided to take all its power requirements in Cape Town from the municipality, and a supplementary supply from the Port Elizabeth Council. They had promised to spend £90,000 on extensions and alterations in Cape Town and about £13,000 in Port Elizabeth. He was confident of the company's future, and said that the directors' conservative dividend policy was justified in view of the expenditure which the company would have to undertake in the near future. The company was in a position to meet motor-'bus competition.

Burma Electric Supply Co., Ltd.

The receipts of the company for the past year, converted to sterling, amounted to £53,012, and the gross profit was £24,094. The addition of £1,840 brought forward, interest on investments, profit on exchange, &c., made the sum of £31,781 available. It was proposed to put £10,000 to general reserve and depreciation fund, and to pay a final dividend of 4 per cent. on the ordinary shares (making 8 per cent. for the year), leaving £6,581 to be carried forward. The general reserve and depreciation fund now amounts to £80,000, and over £20,000 of this has been used for capital expenditure. It was therefore proposed to transfer the latter sum from reserve to capital account by the issuing of 20,000 fully-paid ordinary shares of £1 each to the ordinary shareholders in the proportion of one new share for each five held. The meeting was to be held on Wednesday last.

North Wales Power Co., Ltd.

The accounts for the year ended December 31st last show a profit of £46,479, an increase of £6,002. After meeting debenture interest and crediting £3,218 brought forward, there is available £24,633. Of this £532 is transferred to special contingency reserve, leaving £24,101. With a view to strengthening the company's financial position, an arrangement has been made with the preference shareholders to postpone the payment of their dividend until the constructional work now in progress has been completed. The directors are endeavouring to secure a guarantee in respect of a further sum of £300,000 under the Trade Facilities Acts; this will bring the total guarantee to £2,000,000. The report records an increase of 30 per cent. in the sales of energy. The meeting was to be held on Wednesday last.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Shropshire, Worcestershire and Staffordshire Electric Power Co.—150,000 new "B" ordinary shares of £1 each partly paid and fully paid, Nos. 650,001 to 800,000.

Applications have been made to the Committee to allow the following to be officially quoted:—

International Automatic Telephone Co., Ltd.—430,000 ordinary shares of £1 each fully paid, Nos. 1 to 430,000.

Lucas (Joseph), Ltd.—256,500 ordinary shares of £1 each fully paid, Nos. 502,501 to 759,000.

St. James' and Pall Mall Electric Light Co., Ltd.—640,000 ordinary shares of £1 each fully paid, Nos. 1 to 640,000; and 100,000 7 per cent. non-cumulative preference shares of £1 each fully paid, Nos. 1 to 100,000.

Barbados Electric Supply Corporation, Ltd.—The trading profit for the year ended June 30th last was £11,004, as compared with £10,078 in the preceding year. After providing for debenture interest, taxation, &c., and adding £1,514 brought forward, there remains £9,457. Of this amount £6,000 has been transferred to depreciation reserve and £1,500 to renewals reserve, leaving £1,957 to be carried forward. The number of consumers rose from 3,169 to 3,344, and the amount of energy sold from 493,290 to 566,334 kWh. During the year additional plant and mains were installed at a cost of £14,492. The meeting is to be held to-day (Friday).

Minas Geraes Electric Light and Tramways Co.—The British and General Debenture Trust, Ltd., trustees for the bondholders, have been informed that the electrical services of the Minas Geraes Electric Light & Tramways Company, as and from July 26th last, have been and will be directed by the Government of the State of Minas Geraes. It is also stated that the Government also assumed the responsibility for the 5 per cent. first mortgage bonds, and that in future all remittances will be made by the Government.—*Financial News.*

Hall Telephone Accessories, Ltd.—The accounts for the year ended August 31st last show a net profit of £8,866, and to this is added £1,622 brought forward, making £10,488. It is proposed to pay a dividend of 5 per cent. (making 10 per cent. for the year) and to carry forward a balance of £8,138. The report records the receipt of an important Post Office contract and the satisfactory expansion of foreign business. In conjunction with another company, new premises have been secured at Dollis Hill.

Consolidated Gas, Electric Light and Power of Baltimore.—A dividend of 62½ cents per share has been declared on the common shares for the quarter ending December 31st. The company proposes to issue new common shares in the proportion of one new share for each ten common shares held, at the price of $35 each.

French Companies.—The *Société des Exploitations Electriques* reports net profits of 2,024,000 fr. for 1925-26, as against 1,943,000 fr. in the previous year, the rate of dividend remaining at 17.50 fr. per share.

The *Société Electrique du Nord-Ouest* reports that activity in 1925-26 was specially devoted to the equipment of transformer stations. The accounts show net profits amounting to 4,480,000 fr., and the dividend is at the rate of 37.50 fr. per share.

Swiss Companies.—The *Maschinenfabrik Oerlikon*, of Zurich, proposes to pay a dividend for 1925-26 at the rate of 8 per cent. as in the previous year. It is intended to increase the share capital from 16 to 20 million francs by the capitalisation of reserves which have become free.

The *Société des Usines Electriques de la Lonza*, Basle, is increasing its capital from £1,400,000 to £1,680,000 by the issue of 35,000 new £8 shares, which are being offered at £9 4s. each.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The affairs of the company are being investigated by an advisory committee of prominent business men (including Mr. R. P. Sloan, C.B.E., chairman of the Newcastle-upon-Tyne Electric Supply Co., Ltd.), and as soon as the inquiry is completed proposals will be laid before the holders of the company's debentures, notes and shares.

South London Electric Supply Corporation, Ltd.—An extraordinary meeting was held on November 23rd, when resolutions were passed providing for the increasing of the capital from £310,000 to £7 0 000, and empowering the directors to borrow up to £500,000 or the amount of the issued share capital, whichever was greater.

County of London Electric Supply Co., Ltd.—The proposals giving the directors powers to capitalise reserves, and endowing the preference shares with participating rights in the event of a winding-up were approved at the extraordinary meeting held last week.

South Metropolitan Electric Light and Power Co., Ltd.—Resolutions were passed at an extraordinary meeting on November 23rd increasing the capital of the company to £1,100 000 by the creation of 600,000 shares of £1 each, and providing for the capitalisation of reserves.

Reduction of Capital.—X-RAYS, LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital of this company from £75,000 to £24,265 has been presented to the High Court, and will be heard in London on December 7th.

Major & Co., Ltd.—The directors, in declaring the full dividends for the past year on the 6 per cent. and 8½ per cent. cumulative preference shares, state that they are again unable to recommend any distribution on the preferred ordinary and ordinary shares.

Dublin United Tramways, Ltd.—At a meeting held in Dublin last week the shareholders approved a Bill providing for the acquisition of the Dublin and Lucan tramway.

Electrical Distribution of Yorkshire, Ltd.—At an extraordinary meeting last week the resolutions providing for the doubling of the capital by the creation of 500,000 £1 shares were confirmed.

German Loan in America.—It is reported that the New York firm of Dillon, Read & Co. has made a contract for a loan of $20 million on behalf of the Berlin municipal electricity works.

Calcutta Tramways Co., Ltd.—The directors have decided to defer the payment of a dividend on the ordinary shares until the closing of the year's accounts.

American Telephone and Telegraph Co.—A quarterly dividend of 2¼ per cent. (payable January 15th) has been declared on the capital stock.

Globe Telegraph and Trust Co., Ltd.—A dividend of 5s. per share (net) has been declared on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

VARIOUS shares in the market for London electricity supply issues are now quoted ex the rights to the new shares. Amongst these are Chelseas, Kensingtons, St. James's and Westminsters. Kensingtons are now quoted as £1 shares, and this means that the whole list of shares in our column of electricity supply companies are now of the denomination of £1 with the single exception of Notting Hill 6 per cent. preference, which remain £10 shares.

It becomes a question as to what figures shall be inserted in the yield column of these London electricity supply shares. To take Chelsea as an example, the old shares have been receiving dividends at the rate of 12 per cent., while the new shares will get 7 per cent., the arrangement continuing for five years, after which all the capital will go on to the 7 per cent. basis. In each of the London companies, this lopsided arrangement will continue in force for five years, the Charing Cross being the only exception, inasmuch as its concession runs for another 10 years. The practical man is a little puzzled to know what he ought to do in the way of working out the yields for the guidance of the investor who relies upon the figures provided for his notice, and who takes them as being correct.

Austerely, the correct method would be to adhere to the safe side, and to estimate the dividends on the 7 per cent. basis that will rule in 1931, though to this must be added a prompt rider in the statement that for five years the companies will pay rather more. The declarations are likely to be made in a single amount; that is to say, a company will pay 8, 8½ or 9 per cent., whatever the case may be, for the half-decade, instead of the distributions which are now reflected in our columns. We prefer to put safety first, and have accordingly taken 7 per cent. as the basis of return, though, as already mentioned, it is necessary to add immediately that better results will be available, practically for certain, during the course of the next five years.

The quotation of the various shares ex rights has made comparatively little difference when everything is taken into account. County of London ordinary are better at 3 3/16ths, pending announcement of the official notification as to the distribution of reserves. In the provincial group, Lancashire Light & Power shares strengthened to 24s. 6d., the ordinary shares being offered the right, with the preference shareholders, to subscribe for a new issue of 7 per cent. preference at 24s. The preference already in being stand at 26s.; and, as the shares make a good investment, those who have the right to subscribe should make a point of seeing that they send in applications for shares that are likely to command a modest premium when dealings in them begin.

Brazilian Traction shares improved upon a very pointed circular issued by the directors stating that they would oppose the proposal put forward to amalgamate this company with other concerns of varying nature. This was aimed against the somewhat grandiose intentions attributed to Captain Alfred Loewenstein, of which we have had a good deal to say during the last few weeks. The action of the Brazilian Traction board is natural, and no doubt many shareholders will regard it as being justifiable, in that the Brazilian Traction is doing well enough on its own account to warrant it standing alone, without coming into connection with other undertakings, in Mexico and elsewhere, whose position is less assured.

Mexican Utility bonds are dull. Mexican Light preferred fell to 76½; Mexican Electric Light Fives to 61, Pachuca to 59¼, and the Tramways 5 per cents. at 63¼ have shed a couple of points. Anglo-Argentine Tramways remain weak for the reasons detailed last week, and the uncertainty felt in regard to the possibility of tube transport being introduced into Buenos Aires under other auspices than those of the company itself. British Columbia stocks are good, and there seems to be no stopping the rise in them. The prior-charges, of which the 4½ per cent. debenture is a fair example, have strengthened on the week. British Electric Tractions, ordinary and preference, are both ex dividend.

The Southern Electric Tramways Co. (Buenos Aires) publishes particulars of an issue of 6½ per cent. first mortgage debentures at 93 per cent. which have been underwritten at a commission of 2 per cent. Of these there is £130,000, and it is assumed that dealings will start in the bonds within the course of the next few days. An issue of £150,000 in 7 per cent. convertible preference shares of £1 each is to be made by the Cornwall Power Company this week, the proceeds to be applied for subscription to the Cornwall Electric Power Company, which supplies power in bulk to the Urban Electric Supply Co., Ltd., and several other undertakings.

Circulars are being distributed by the Electricity, Gas, Share Debenture Investment and Guarantee Trust, Ltd., offering 7 per cent. first mortgage debentures and 8½ per cent. preference shares in the Southern Counties Electric Light and Power Supply. We have so frequently written warnings against this group upon previous occasions that it seems almost unnecessary to add further caution on the subject. The persistence of the circularisers suggests that their efforts meet with a certain degree of success amongst the unwary.

Cable stocks and shares are quiet, there being very little business doing in this market. The satisfactory report issued by the Western Telegraph Company has served to keep prices firm, but there is no feature of any particular interest. Prices are unchanged. Automatic Telephones have gone back 1/16th to 56s. 3d. The wireless group is quiet, Canadians being a little lower at 3s. 7½d.

In the Home Railway market Districts have lost another part of their recent smart rise. The difficulties experienced in the Underground Companies' coal supplies, revealed by the slowing-down of Tube trains on Monday in this week, are a reminder of the trouble which the group must have faced during the coal stoppage. Other Tube issues remain steady. London Electric ordinary has been the centre of a little business around 56½. London United Tramways debenture advanced to 42¼.

General Electrics strengthened to 31s., a rise of 1s. 6d. on dividend anticipations. Other shares in the manufacturing section have been hard. Henleys recovered the dividend deduction made last week. English Electrics firmed up to 15s. on the hope that the company's ordinary shares will shortly re-enter the dividend stage. The rubber share market is dull and lower. Engineering and allied shares failed to derive any advantage from the fizzling out of the coal strike. Armstrongs are flat, fears being entertained that there will have to be a drastic writing down of capital. An influential committee has been appointed to go into the matter, and the report of these experts is awaited with some little nervousness.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1924.	1925.	Price Nov. 29 1926.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	1⅛	—	6 13 4
Charing Cross Ordinary	1	15	15	2⅛	—	6 9 9
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	24xr	—	5 14 3
City of London	1	15	15	59/9	—	5 18 3
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	8⅞	+⅛	4 14 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	90/6	—	6 11 2
Kensington Ordinary	1	15	15	24/6xr	—	5 14 3
Lancs. Light and Power	1	7½	7½	24/6	+6d.	6 2 5
London Electric	1	10	10	86/-	+6d.	5 11 1
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	40/9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary ...	1	7	7	21/8	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	—xr	—	... ...
South London	1	15	15	2⅜	—	5 14 8
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	7	1¼	—	5 12 0
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	25/6xr	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	62	—	8 1 4
do. District	,,	5½	5½	86½	−½	6 4 0
Underground Electric	£1	Nil	Nil	12/6	—	Nil
do. do. Income ...	Bonds	6	6	102	—	*5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	24½	—	6 1 3
Automatic Telephone	1	8	10	2½	−⅛	8 16 7
Chili Telephone	5	5	6	6¼	—	4 7 4
Cuba Sub. Ord.	10	5	5	7⅛	—	7 0 4
Eastern Extension	10	10	10	18½	—	*5 10 4
Eastern Tel. Ord.	Stock	10	10	180½	—	*5 10 10
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 6 8
do. do. Pref.	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	9½	10	47½	—	*5 5 10
Marconi	1	10	Nil	⅛	—	... ...
Marconi-Marine	1	10	7½	1⅛	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅞	—	*4 18 4
United R. Plate Tel.	5	8	8	7⅛	—	*5 2 5
Western Telegraph	10	10	10	17½	—	*5 12 8

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2⅛	−⅛	10 0 0
do. do. 2nd Pref. ...	5	6	6	2½	—	11 8 2
do. do. 5% Deb. ...	Stock	5	5	65½xd	—	7 12 8
British Electric Traction Ord. ...	,,	7	8	142½xd	—	5 12 3
do. do. 6% Pref. ...	,,	6	6	109xd	−1½	5 10 1
Brazil Traction	100	4	5	108	+3	4 12 9
Brit. Columbia Elec. Ry. Pos. ...	Stock	5	5	86½	—	5 15 7
do. do. Preferred ...	,,	90/-	126/9	117½	+1	*5 8 2
do. do. Deferred ...	,,	129/5	8	147½	+2½	*5 10 4
do. do. Deb. ...	,,	4½	4½	77½	+1	5 10 0
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	42½	+2	9 8 4
Mexico Trams, 5% Bonds	—	5	5	63½	−2	7 17 6
Mexican Light Common	100	Nil	Nil	82½	—	Nil
do. Pref.	100	Nil	Nil	76½	−1	Nil
do. 1st Bonds	—	5	5	65½	—	7 12 8
Yorkshire (West Riding)	1	5	—	12/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	54/-	—	4 12 10
British Aluminium Ord.	1	5	10	47/6	—	4 4 3
British Elec. Transformer Pref. ...	1	Nil	7	18/8	—	7 13 5
British Insulated Ord.	1	15	15	67/-	−6d.	4 9 7
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	8½	—	4 12 4
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	8 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	22/-	—	6 5 0
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	5	Nil	15/-	+6d.	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	2⅛	—	5 18 1
do. Ord.	1	5	7½	31/-	+1/6	4 16 9
Henley	1	16	20	4xd	+⅛	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 9 0
Johnson & Phillips	1	10	17½	56/3	—	6 0 2
Met.-Vickers Ord.	1	8	8	23/9	—	6 14 9
do. Pref.	2	8	8	2½	—	6 18 4
Siemens Ord.	1	7½	7½	29/6	—	5 1 8
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Nov. 30th.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£26 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£278	2 inc.
Grade II ... ... ,, ,,	£194	£1 inc.
Grade III... ... ... ,, ,,	£1.1	...
c Brass (rolled metal 2" to 12" basis) per lb.	10½d.	...
c ,, Tubes (solid drawn) ... ,,	1/0 to 1/0½d.	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1	...
c ,, Bars (best selected) ... per ton.	£92	...
c ,, Sheet ... ... ,,	£92	...
c ,, Rod ... ... ,,	£92	...
d ,, (Electrolytic) Bars ... ,,	£65 5s.	17s 6d. dec.
d ,, ,, Sheets ... ,,	£74 10s.	...
d ,, ,, Wire Rods ,,	£75 5s.	17s 6d. dec.
d ,, ,, H.C. Wire per lb.	9⅛d.	½d dec.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1.6½	1½d. dec.
i Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£91	...
g Lead, English pig ... ... ,,	£30 10s.	5s. dec.
g Mercury ... ... per bot.	£17 10s.	10s. to 15s. inc.
e Mica (in original cases) small ... per lb.	9d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/4	...
o Platinum ... ... per oz.	£28	...
d Silicium Bronze Wire ... ... per lb.	10½d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£315 to £315 10s.	£3 10s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

B.E.S.A. Publications.—The British Engineering Standards Association has recently issued a specification for fixed condensers for radio reception purposes. It deals with two types, those in insulating-material cases, and those in metal cases, the sizes in each type being confined to the limits suitable for radio reception purposes. They are sub-divided according to the nature of the dielectric, the recognised materials being mica and paper. Each type of condenser is standardised in two grades, these being based on the closeness of the actual capacity value to the nominal capacity value marked on the case of the condenser. The electrical properties of the condensers are specified by means of power factor, insulation resistance and high-voltage tests, and the constancy of capacity is covered by a heat test. The dimensions of the fixing holes are also specified. Beyond this it has been considered inadvisable to attempt the standardisation of dimensions at present. The aim in the preparation of this specification has been to safeguard the purchaser against unreliable goods, at the same time enabling the condensers to be made at a reasonable price. In cases where the manufacturer holds a licence from the British Engineering Standards Association the trade mark "BESA" may be marked on the condensers to show that they comply with the requirements of the specification. Copies of this new specification, No. 271—1926, may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 1s. 2d., post free.

The list of recommended panel sizes contained in the B.E.S.A. specification for ebonite for panels for radio reception purposes, November, 1925, has been revised. The standard thicknesses have been reduced from three to two by the elimination of the 5/16 in. thickness, but the number of standard panels remains in the neighbourhood of 20. Copies of the revised list of panel sizes, No. 231—1926, will be forwarded by the B.E.S.A. Publications Department on receipt of a stamped envelope.

Rural Electrification in Sweden.

By ALFRED EKSTRÖM, D.Sc.

(*Concluded from page* 874.)

Both the Royal Board of Waterfalls and the South-Swedish Power Co. have developed extensive rural electrification systems within their districts. That of the Royal Board contains about 28,000 Eng. sq. miles, with a population of 2.4 millions, of which 0.7 million are living in towns and 1.7 millions in the country. The arable area of this district is 7,000 sq. miles, divided among 171,000 separate farmsteads, thus corresponding to an average of 27 acres for each farmer.

The South-Swedish Power Co. (excluding Denmark) contains about 16,000 sq. miles with a population of 1.5 millions, of which 0.4 million are living in towns and 1.1 millions in the country. The arable area of this district is 4,000 sq. miles, divided among 116,000 farmsteads, thus corresponding to an average of 23 acres for each farmer.

About 1908 the "Hemsjö Power Co." started systematic work on the electrification of whole districts in the country.

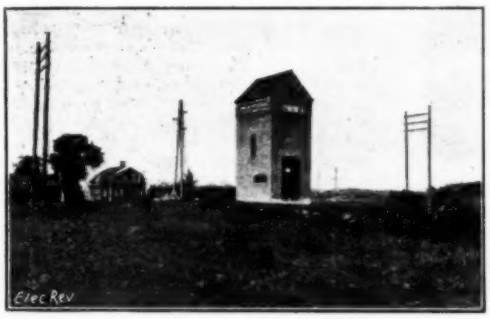


Fig. 5.—Transformer House.

It built in south-east Sweden not only water-power plants, h.p. mains and country lines, but also the local networks for the communities, and supplied the electrical energy retail to the individual consumers.

The building of these country lines and local networks required considerable capital, and application was made to the consumers for this purpose. In a district, proposed to be electrified, the consumers formed themselves into a co-operative society, which arranged for loans to the company, generally from the local savings-banks, on favourable terms. The societies had nothing to do with the construction of the local network, nor with its upkeep and management. Generally speaking, it has been found economically possible to electrify such a district as soon as the payments for the power consumed amount to 20 per cent. of the cost of the local network and its share of the necessary country lines.

It has been feared that a large and expensive organisation would be necessary for so many thousands of consumers, spread over large areas. By the introduction, however, of mechanical book-keeping and the most up-to-date standardising methods, this management has proved quite simple and economical.

The Royal Board of Waterfalls, in 1910, began rural electrification from the plant at Trollhättan and extended it over the whole of Central Sweden as soon as the Alvkarleby water-power plant was ready for use in 1915. This electrification, carried out by the Royal Waterpower Board, is an entirely wholesale supply, and the Board has divided central Sweden into about 400 small local distribution districts, each with an average area of about 20 sq. miles. It builds country lines to a central point in each district, where it transforms the pressure down to 3 or 1.5 kV, and sells the energy at wholesale rates. The Board hands over to a local organisation, consisting of the leading men of the district, the sole right to build the local network with quaternary transformers for low pressure, and the management of the retail supply of the district.

The consumers in the district generally form themselves into a co-operative society, as in the case of the South-Swedish Co.

Economic electrification requires a certain density of population as well as a fair standard of general prosperity and a popular appreciation of the advantages of electricity in daily life. It may be of interest to give some results obtained in a purely rural district, the south-east of Scania. The following economic data are based on present-day prices. The total area of this district is about 200 Eng. sq. miles. The entire cost of the plant for the country lines and local network with tertiary and quaternary transformers, but excluding the networks in two municipal boroughs within the district, is about £60,000. There are no large industries in this district, and those engaged in the small industries are more or less dependent upon the agriculturists. In the whole of this district there are 2,600 consumers. The output amounts to 1,050,000 kWh per annum and the revenue to £14,300, which is exactly balanced by the total expenditure. The total cost of the supply system amounts to £23 per consumer, £2 per inhabitant, and £310 per square mile total area. The average consumption is 34 kWh per inhabitant, 65 kWh per square mile of arable area, and 400 kWh per consumer. The average charge for the energy is 3.25d. per kWh.

The data given above prove that rural electrification, where the annual income is at least 20 per cent. of the entire building costs, will produce a satisfactory economic result.

These tertiary transformer stations (20/3 or 20/1.5 kV) on the country lines, are constructed either as mast-transformer stations, with outdoor equipment or with indoor equipment, in a small house, fig. 5.

The mast-transformer station is easily built without the need of skilled workmen or of special building materials; its annual cost of upkeep is inconsiderable; and the initial cost of erection is low.

The indoor station is preferable when the electric energy is to be supplied by, and measured in, the tertiary transformer station; in more populous areas where many transmission lines radiate; and in places where the open mounting would cause inconvenience or spoil the scenery of the landscape.

Within the system of the Royal Board all the energy is, as a rule, transformed down to 3 kV, and the local h.p. network radiates to the different farms or to groups of them. There the quaternary transformers are arranged, and the pressure is generally transformed from 3,000 to 380/220 V, both for large and small motors, and lighting. In certain cases, however, the quaternary transformer supplies only lighting and small motors, whereas the larger motors receive power from a portable transformer, connected directly to the 3-kV lines.

Within the system of the South-Swedish Power Co., the pressure at the tertiary transformer station is transformed from 20 kV to both 1,500 and 220/127 volts. In the district situated in the neighbourhood nearest to the transformer station, where the consumption as a rule is greatest, the energy for small motors and for lighting is directly delivered at 220/127 V, whereas 1,500 V is used for larger motors, connected to the 1,500-V lines with a special device. The 1,500-V lines are extended to the consumers at a greater distance from the tertiary transformer station. These also employ 1,500 V directly for large motors, but for smaller motors and lighting the pressure is transformed to 220/127 V by quaternary transformers, arranged either for each farm or for groups of neighbouring farms. By this arrangement the losses on transformers and lines are considerably reduced.

Fig. 6.—Mast Transformer.

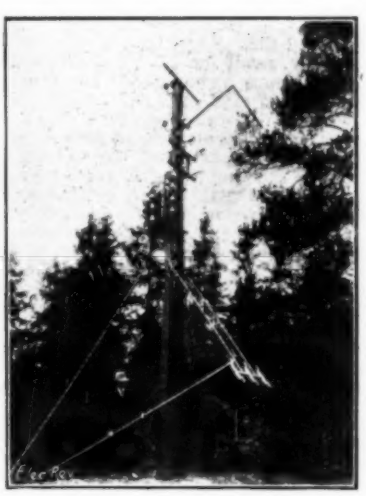


Fig. 7.—Mast Equipment, Frame Lowered.

A suitable type of quaternary mast-transformer station is shown in figs. 6 and 7. The h.p. lines are connected with three insulators at the top of the mast, and these are connected with three horizontal insulators, under which three other insulators are horizontally arranged, connected with the h.p. winding of the transformer. Between these two rows of insulators, which are furnished with sliding contacts, three h.p. fuses, provided at both ends with knives, are horizontally arranged on a movable frame. The knives fit into the sliding-contacts, thus

connecting the three incoming h.p. lines with the h.p. windings of the transformer.

The frame is lowered to the ground for changing or repairing the fuses, fig. 7.

From the l.p. windings of the transformer l.c. cables are connected to a switchboard for the outgoing lines, and placed either on one or between the two masts. The single-mast type can be used for transformers of up to 10 kVA capacity. These lines are carried up the masts in lead-covered cables and radiate thence to the various farms and consumers.

Rural electrification is, above all, appreciated for electric lighting on account of its convenience and other well-known advantages. In connection with the introduction of electric motors for driving the different machines on a farm, it usually necessitates imparting much information to, and propaganda with, the farmers to make them understand what use

Fig. 8.—Portable Motor Driving Thresher.

Fig. 9.—H.P. Portable Motor.

they can have in their daily work for an electric supply. As regards the pumping of water, electrotechnics have in a remarkable way transformed one of the most important, but at the same time hard and dull, tasks of every-day life. There are indeed few branches of farming where electricity presents such indisputable advantages.

With the appearance of the centrifugal pump, however, a machine was found that could be directly coupled to the electric motor, which, of course, was a great advance. Yet the plunger pump is sometimes to be preferred to the centrifugal pump, *e.g.*, when there is a small quantity of water which has to be pumped to a great height. The water consumption on a farm varies greatly, and storage accommodation is necessary. This usually consists of a water tank, either of the open or enclosed type. In the latter case the water is conveyed to a closed tank, the hydrophore, partly filled with air which is compresed by the water sufficiently to force the water to the taps. Both systems are usually equipped with automatic starting and stopping devices. A squirrel-cage motor can generally be used; a reliable automatic switch should be used for protecting the motor. It may be mentioned that a system with an open tank must be considered as more reliable and more easily maintained than a hydrophore. The daily amount of water needed by small farms or households is so little that the smallest pumps manufactured are generally quite sufficient.

Milking by electricity should prove a boon to the rural population. The inconveniences of handmilking are manifold. It ought to be stressed that if the cows are not well, but roughly, treated, and the milking is not uniform and thorough, this inevitably means less milk and a lower fat content than the maximum obtainable from the same cows given the same rations. As regards the hygienic point of view, open pails are naturally conducive to the fouling of the milk by foreign matter. A strainer, however fine the meshes, can at the best remove but a part of the dirt.

Sweden was not one of the first countries to try mechanical milking, and therefore avoided the inevitable set-back which was brought about in the countries where the earlier and inferior machines were tried on a larger scale. Latterly, machines have been greatly improved, and mechanical milking has developed so rapidly in Sweden that that country is now second only to New Zealand in that respect. A milking machine of the latest type is manufactured by the Alfa-Laval Company, which marketed the first continuous centrifugal cream separator, and, as regards the milking machine, has behind it experience which has been gained in New Zealand. I am informed that this milking machine is becoming known in England.

In order to keep the milk yield and the fat content at the highest possible level, and to escape udder troubles, the cows must be milked thoroughly dry. A good milking-machine can easily give this result.

In the general milking plant an electric motor, of from 1 to 3 h.p., actuates a specially designed vacuum pump. An iron pipe line connects this to a point near the cows, and a gear-driven slide valve creates an intermittent vacuum. The "pulsations," each consisting of a vacuum and an air-pressure impulse, are by means of a special pipe line conveyed to teat cups which imitate the suction of a calf, not hand milking, which is a most unnatural method.

Considering that each milking unit will perform the work of one person, and that one operator can attend to, say, five units, it is evident that a good milking machine will be profitable and that the expenses for operating will be very small compared with the labour saved. It is significant that whereas a decade ago the milking plants in Sweden averaged one to about every 60 cows, the average size sold to-day has dropped to about one for every 20 cows, and of these more than 12 per cent. are for 10 cows or less.

The weekly chaff requirements for a farm can be conveniently cut, by means of electricity, in a few hours. The work requires from 1 to 2 h.p., and the energy consumption is about 0.2 kWh per 100 lb. of chaff. Where peat is available it can be turned into moss-litter, a valuable manure, if mixed with the liquid-manure from stable and byre. This operation requires from 2 to 3 h.p., and the energy consumption is 2 kWh per 100 cu. ft. A manure pump which has been found to fill all the reasonable farm demands is manufactured by Mr. P. Mortensen, Herning, Denmark, and requires about 1 h.p.; the energy consumption is 3 kWh per 100 cu. ft.

It is important to check the growth of the bacteria in the milk as soon as it is received in the dairy. This can be done effectively by means of a tubular cooler. For this purpose and for cleaning the machines and the various milk containers, a plentiful supply of water is necessary, and here again an electric motor comes in useful as the source of power for pumping.

A typical small farm dairy for the making of country butter is equipped with a cream separator, revolving churn, and a butter worker. The separator is driven by a small electric motor of about ¼ h.p., which, by means of a special pulley, also serves to drive the butter worker.

For heating water for cleaning milk utensils, especially the milking machines, an immersed electric heater, automatically controlled for constant temperature, comes in very handy. The electric elevator is used extensively in Sweden. The wagon-load of hay or crop coming in from the field is unloaded and brought to the desired spot in the barn or loft by means of a run-way controlled by a winch and a flexible wire rope. If the stable and the barn are housed in the same building, the same winch and run-way can be used for both parts. The whole load is hoisted in one operation from the wagon as it comes from the field by a load-carrier consisting of two ropes and a pole, which, before loading, is placed in the bottom of the wagon. By means of locks at the end of the ropes, these are placed round the load, so as to keep it properly together during transport.

A winch for controlling the whole arrangement is driven by a 5-h.p. motor. Grain, which has to be threshed imme-

Fig. 10.—Portable Equipment for Various Drives.

diately, is carried direct to the feeding-board on the threshing machine. Estimated costs show that in the case of a hay-loft not equipped with an elevator, 50 wagon loads can be dealt with for an expenditure of £3 5s., while, where an electric elevator is used, 100 loads can be dealt with for £4 17s. This means that with an electric elevator plant on a farm of 250 acres, with a harvest of 800 wagon loads, the harvest can be carried in half the time it takes on a farm without such a plant, and yet show a profit of about £13.

For many years the electric exhauster has been used for transporting the husks by blowing them from the threshing machine through tubes hundreds of yards long to the storage. It has now been found practical also to transport the straw, from which the ears have just been threshed, direct from the threshing machine, through tubes up to 200 yards long, either to the straw-rick or to the loft. The straw is protected against rain and loss in transit, but is somewhat crushed. The capacity of a suitable exhauster is as much as 4,000 lb. an hour. For a tube 100 yards long 7 h.p. is required, 1,000 r.p.m. During the last two years I have, however, employed the blower also for blowing grain direct from the threshing machine through a tube 60 yards in length to the fourth

floor of the granary, and the system works admirably. It was feared that the germination of the grain might be affected, but these fears have proved to be quite unfounded. The size of the necessary apparatus is about the same as that used for the transportation of straw.

On large farms a part of the straw is sold. It must be properly packed. A straw press connected to the threshing machine will in this case be valuable, and will require about 2 h.p. The energy consumption is about ½ kWh per 100 lb.

Machines for winnowing and corn-riddling are employed for waste grain, toppings, clover and seed corn. They require from ½ to 1 h.p., and the consumption is about ½ kWh per acre.

Cake crushing for the cows can be effected for a consumption of about 0.5 kWh for 1,000 lb.

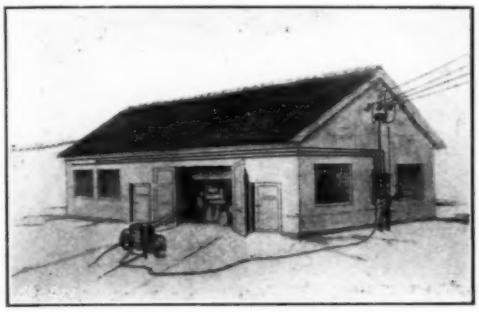


Fig. 11.—Small-farm Wiring.

For rolling and crushing the corn for animal fodder and for grinding the grain for human food a smaller mill is often used. The consumption for crushing grain is ½ kW per 100 lb.; for rolling grain, 1 kWh per 100 lb.; and for grinding, 1½ kWh per 100 lb.

The most important advantages in the use of the electric motor for threshing are the elimination of fire danger, the availability of the electric motor for immediate use, and the even threshing rate which can be maintained. It frequently happens that threshing equipment for common use is procured jointly by several small farm-owners. The total area to be served in such a case should not be less than 500 acres. The average crop in Sweden is from 3 to 5 bushels of autumn-sown grain and 10 to 15 bushels of spring-sown grain per acre on the total area of arable land, and the energy consumption is about 30 kWh per 100 bushels of autumn-sown grain and 20 kWh for each 100 bushels of spring-sown. The size of the motor required to drive a threshing plant varies from 5 h.p. for a 17-in. cylinder to 40 h.p. for a 66-in. cylinder.

The electric motor can be used to great advantage for driving the blacksmith's and carpenter's machines on the farm, *e.g.*, forge bellows, drilling machines, saws, and grinding machines. During the spring and early summer the climate in Sweden is rather dry. This has given rise to the idea of artificial irrigation. Apparatus used for this purpose consists of a pipe line through which the water is pumped. At equal distances in the pipe there are bored small holes, through which the water is forced in many parallel jets, all located on the same plane. By means of a "water motor" a slow half-rotary motion is imparted to the pipe, and consequently also to the jets of water, giving equal distribution. The resulting economic profit from such a plant is difficult to estimate, but during a dry season the whole outlay for the plant might be saved.

The heating of greenhouses by electricity is feasible if the electric energy is sold at a sufficiently low rate. If 1 ton of coal costs 16s., the electric energy must be cheaper than 0.04d. per kWh.

Good economic results have been obtained in the electric heating of hot-beds in the neighbourhood of the large cities. Special resistance cables are constructed for this purpose and are placed in the soil of the beds. The energy consumption during the winter time is about 12 kWh per sq. ft. in 24 hours.

For many years I have been ploughing by electricity on my farm at Ahlby with the so-called dual-machine system, a balance plough drawn by means of a steel-wire cable from two portable motors placed opposite to each other. The results have, however, not been economically profitable. It may, however, be of interest to mention that in Germany lately rotary tillers have aroused great interest.

The driving requirements of the farm may be met by providing every machine, or group of machines, with its own stationary motor, or by means of several motors which can be used for driving different machines at different times. On large farms a motor is often permanently installed in the barn, together with the threshing machine and its auxiliary machines. This arrangement has the advantage of a convenient service at a low pressure, but it possesses the drawback that a large transformer has to be installed.

Fig. 8 shows threshing operations by means of a portable motor. The latter is carried on an iron wheelbarrow, provided with ball-bearings, and protected in a watertight casing. The necessary starting apparatus is also completely enclosed.

On a typical Swedish farm the energy for threshing is taken direct from the 3,000- or 1,500-V line, which is brought to a pole, placed close to the granary. The pole carries the contact by means of which the motor equipment is connected to the line. The contact consists of two parts, one placed at the top of the pole and directly connected to the conductors, and a portable part connected to a specially-constructed cable, the other end of which is connected to the h.p. side of the transformer or motor. The cable is specially designed to stand the rough usage to which it is subjected.

In the south of Sweden, when using 1,500 V, a motor, specially wound for this pressure, is directly connected to the h.p. line. Fig. 9 shows a h.p. portable motor used for threshing; this scheme is, from a technical point of view, the simplest and cheapest.

For driving the machines of the granary an electromotor of 3-5 h.p. is, as a rule, sufficient, and is generally of the portable type. In some districts smaller threshing machines, requirin gonly 5-7 h.p., are used, and in these cases the same motor is generally used for both the threshing machine and the machines of the granary. Fig. 10 shows the arrangement adopted for a portable motor used for driving the stable machines, chaff cutter, vacuum pump, churn and butter mixer, and so on.

Fig. 11 shows a suggested method of wiring for the small farm. The incoming lines are fixed to insulators placed on the gable-end of the combined stable, barn and granary building. Within reach of the ground a main switchboard, fig. 12, is arranged, from which the required circuits emanate. The service meter for the farm is also arranged on the switchboard.

Another arrangement provides a pole in front of the building, on which the incoming lines terminate. Within reach from the ground the main switchboard is placed on the pole itself, from which two circuits emanate; one to the portable motor for threshing; and one to an auxiliary switchboard placed on the wall of the building, from which the lines radiate to the different departments.

Pioneer work in Sweden has led to the introduction of rubber and lead cables for farm wiring. The accessories must also be able to resist corrosion, and they must be made for air-tight connection to the rubber and lead cables.

The Sievert Cable Works has perfected and marketed an installation system, the "SS-System," for damp and inflammable premises. This system embraces airtight connection boxes, switch boxes, and so on, to which rubber and lead cables may be attached with airtight connections.

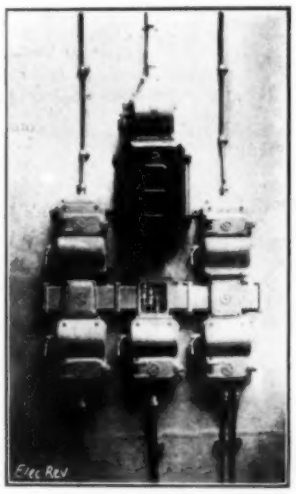


Fig. 12.—Outdoor Switchboard.

In connection with the supply of electricity for domestic purposes, the main condition for the use of electric hot-water cisterns on a large scale is a reliable and cheap thermostat. The best thermostat at present on the market is, in my opinion, the "Birkaregulator," invented by Dr. Axel Appelberg, in Stockholm. This device, which employs tungsten contacts in a high vacuum or inert gases, enables the erection of a quite small, cheap, and reliable apparatus. It is suitable for a 1-kW loading on 220 V.

Credit for the prolonged and valuable work devoted to the elaboration of a practical and serviceable accumulating electric cooking range is due, in the first instance, to the Stockholm Electric Works, which has marketed the Seves Range [ELECTRICAL REVIEW, September 17th, 1926, pp. 445 and 473].

Electricity on Orcadian Farms.—An interesting glimpse of the possibilities of farming by electricity, even in the remote northern isles, was given by Mr. W. C. Roy, manager of the Kirkwall Electric Power Station, in the course of an address to the members of the Orcadian Agricultural Discussion Society, at Kirkwall. Given a central point of generation and control by the installation of Diesel engine-driven alternators, it would be possible, he said, to give a supply to most of the farms on the mainland of Orkney at 3d. per kWh. Mr. Roy added that he foresaw the time—possibly within the next 20 years—when farmers would wonder how they ever managed to run their farms without electricity.

The Progress of "Wireless," 1919-26.

By Prof. C. L. FORTESCUE, O.B.E., M.I.E.E.

(*Abstract of Chairman's Address to the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

SOME twelve months ago doubts were expressed in certain quarters as to whether the professional value of membership of the Wireless Section was as great as it should be, and as to whether the requirements for corporate membership did not prevent many expert wireless technicians from joining the Institution. The rules of the Section were carefully scrutinised, and certain alterations were submitted to and approved by the Council of the Institution, which are given in detail in the annual report. The general effect of these alterations is that membership of this Section now signifies active participation in wireless telegraphy, together with a thorough training in either pure or applied electrical science. The professional status conferred by membership of this Section is now at least as high as that conferred by membership of any other institution or society. In addition, it has been decided to inaugurate Local Wireless Sections at any of the Institution's local centres where sufficient interest is shown.

The time may be appropriate for a critical review of the developments of the last seven years in which some attempt is made to ascertain the nature of the changes in both theory and practice, and to gain some insight—if possible—into the directions of future progress.

Transmitters.

The spark transmitter is the least expensive and most fool-proof method of wireless communication when signals are few and refinement is unnecessary; it does, however, cause such serious interference that it cannot be long before its use will be limited to emergency signals and to regions where there is little traffic.

The arc generator is unchanged. The necessity for a coupled circuit—except perhaps at the lower frequencies—was fully recognised even earlier than 1919, and recent experience has shown that it is the only way in which an arc can be used to generate an aerial current of reasonably good wave-form. The use of capacity coupling by the engineers of the General Post Office has proved to be a real advance, but it seems unlikely that even with this assistance the arc will be able to hold its own against the high-frequency alternator and the power valve.

Both the American and French designs of high-frequency alternator date from the beginning of the period under review, though much of the preliminary experimental work had been carried out earlier. Both types appear to give satisfaction for the purposes for which they were designed. The Alexanderson alternator has a fundamental frequency equal to that of the aerial current; the Latour alternators used in France have windings giving a fundamental wave-form such that there is a marked harmonic of the desired high frequency.

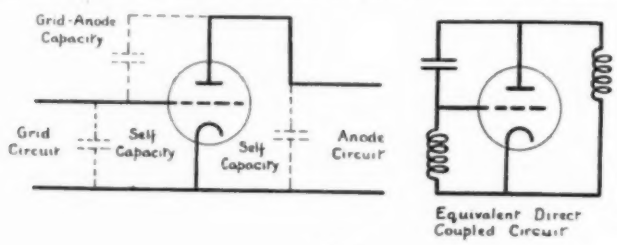


Fig. 1.

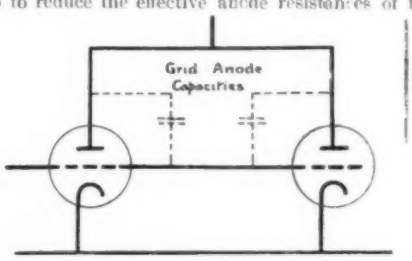


Fig. 2.

The development of the power valve since 1919 has followed closely on the lines foreshadowed. The limitations imposed by a glass bulb were recognised at that time, and it was clear that increase of power would necessitate either water-cooled anodes or the use of fused quartz or some similar material capable of withstanding a higher temperature. Each alternative presented the same problem, namely, that of making a satisfactory seal with leading-in wires capable of carrying considerable currents. It was dimly recognised, also, that in any form of large valve some limitations might arise from what is now known as the magnetron effect.

The development of the silica valve by the staff of H.M. Signal School, Portsmouth, has been described before this Section. An infinity of difficult problems presented themselves, to be overcome one by one, until finally for a power dissipation up to 25 kW at the anode, something approaching perfection has been attained.

The water-cooled power valve now most commonly used was rendered possible by the discovery of a technique enabling reliable vacuum-tight joints, up to even several inches in diameter, to be made between glass and nickel-steel. This discovery was immediately applied by the Western Electric Co., and the type of valve commonly associated with the company's name quickly became a practical commercial product. The power dissipation for which it was designed was in the first instance little more than that provided for in glass valves, but the water-cooled construction was on sounder engineering lines, and as the power has been gradually increased to values far exceeding anything possible with glass, this fact has been fully demonstrated. This type of valve is permanently sealed, and it has the same disadvantage as a silica or glass valve, namely, that replacement of the filament involves the re-making of vacuum-tight joints and re-pumping under similar conditions of heating and bombardment as when the valve is first made. This is a costly process, and leads to the use of long-life filaments running at low temperatures and requiring heavy heating currents. This, in turn, accentuates the limitations arising from the magnetron effect and adds appreciably to the amount of power that has to be dissipated from the valve.

An alternative type of water-cooled valve—initiated in this country but developed in France—is run permanently connected to a high-vacuum pump. In general form it is similar to the Western Electric type, but ground metal joints are used instead of permanent seals, with the result that the valve may be taken apart for filament renewal almost as easily as a receiving valve may be withdrawn from its holder.

Opinions are divided as to which of these three types will ultimately prevail, but that the valve is the only practicable generator where frequencies in excess of about 15,000 cycles are required is now generally accepted.

The question of the rating of power valves is still to some extent a bone of contention. At the end of the war period the safe anode dissipation, taken in conjunction with the emission current and the safe maximum anode voltage, was generally regarded as the most useful measure of the capabilities of a valve. Recently there has been a tendency to use the total power input to the valve as its rating. As actually used, the efficiency of the valve—irrespective of the power used to heat the filament—depends upon the permissible harmonics in the wave-form of the generated current, the maximum emission current, and the safe working voltage. A compromise has to be effected, and for a given power input the power expended at the anode varies with the different conditions of use. As serious overloading of the anode almost inevitably leads to disaster, it is difficult to avoid the conclusion that the anode dissipation, together with the safe maximum voltage, is the more reliable guide. Closely allied to the rating question is that of the most appropriate grid-closeness factor for power valves. Early experience led to the impression that it was easier to obtain a high and permanent vacuum without serious damage to the filament in a valve having a close grid than in one with an open grid, but with increased power and with voltage limitations due to auto-electronic emission, the necessity for lower m-values became evident; and to obtain good efficiencies it has become necessary also to reduce the effective anode resistances of the valves. Increase of cathode area is thus required, and the ease with which this can be provided may well be the factor determining which of the three types of valve will eventually be found to give the best results.

With regard to the circuit arrangements used with the valve generators, coupled circuits and master oscillators were well known and in use before 1919. The use of a harmonic of a tuning fork at Rugby is an innovation that is likely to become standard practice, giving, as it does, reliable frequency control subject to no greater errors than that of the tuning fork itself. Looking ahead, it is possible to imagine a large number of transmitters—all the principal stations in a country, for example—controlled from one master-fork maintained at a central standardising establishment such as the National Physical Laboratory in this country. The need for ever-increasing accuracy of frequency, as the number of lines of communication is multiplied, makes some step of this kind essential in the near future.

A difficulty that has frequently presented itself in all forms of high-power valve sets is a tendency to oscillate at very high frequencies. These oscillations may occur in various ways, but the capacity between the grid and anode always plays an important part. With a single valve the leads to the anode and grid constitute inductances in series with the capacity between these electrodes. At frequencies such that all other instruments connected to the valve are effectively

short-circuited by self-capacity, this circuit becomes the familiar direct-coupled Hartley circuit as shown in fig. 1. The conditions for self-oscillation require positive reactance from grid to filament and from filament to anode. If the circuits can be so arranged that this condition cannot be satisfied, the high-frequency oscillation will be eliminated. In practice this end is attained by deliberately increasing the capacity between the grid and the filament *inside the valve* in such a way that with any reasonably designed circuit the grid-filament reactance will be negative at any high frequency at which a Hartley oscillation might otherwise be possible. With more than one valve a similar Hartley oscillation may occur, but in addition to this, any pair of valves in parallel may oscillate on the "push-pull" principle, the circuit consisting of the anode leads and the grid leads in series with the two grid-anode capacities as shown in fig. 2. Where a large number of valves is used in parallel, any pair, or combination of several valves acting as a pair, may oscillate in this way. The number of possibilities is thus very great, and it is essential that all of them shall be guarded against. The conditions for oscillation require a positive reactance between the two grids. Capacity within the valves between grid and filament is therefore again a preventive. Other possible steps are to use resistance connections to both anodes and grids with or without parallel capacity. The function of this capacity, it may be observed, is to carry current of the normal frequency and not of the high frequency—the latter being effectively shunted through the resistance by the inductance of the connecting leads to the condenser.

An unexpected advance since 1919 is the discovery by the engineers of the General Post Office of the remarkable insulating properties of good-quality American whitewood. This discovery has removed a serious mechanical difficulty in the construction of large inductances of low resistance, and the reason for the high efficiency as an insulator is a fascinating scientific problem.

Constructionally, the valve transmitters have gone through the same phases of development as the spark transmitters. From being a collection of small constituent parts assembled haphazardly and giving correspondingly uncertain results, they have come to consist of one, two, or, at most, three complete, self-contained units which, after installation, behave exactly as when adjusted in the factory.

Short-wave transmission—that is to say, transmission with frequencies above about three million cycles per second—had been used for short ranges before the autumn of 1919. The development of this system for lower ranges, and particularly the use of "beam" stations, has been carried out wholly during the period under review. Stations are in existence which radiate more than 80 per cent. of their energy in a beam having a dispersion of no more than 15 deg. The generation of the high-frequency currents called for modifications in the construction of the valves owing to the large capacity currents to the electrodes—generally far exceeding the currents arising from the streams of electrons within the valve.

The modulation of the high-frequency current in the transmitting aerial, whether for Morse signalling at either high or low speed, or for telephony, has been perfected in detail. The demand for true rendering for broadcasting has compelled close attention to the microphones, land lines, and accessory apparatus. The microphones now available are less sensitive than those previously in use, but give results of a different order of perfection from anything that had been accomplished before 1919. These microphones and their amplifiers are, unfortunately, too complicated for ordinary line telephony.

With regard to the purely theoretical aspects, it is now customary to think of all forms of modulated currents—even including spark—as consisting of a carrier wave and appropriate side-bands. The distribution of magnitude of these side-bands—which extend over an infinite range of frequency in most cases—determines the width of the band of frequency required for each line of communication. Hand-speed Morse with a continuous wave requires only a narrow band; high-speed Morse and telephony have a wider spread of the side-bands, and spark transmission involves the widest band of all.

The Transmitting Medium.

Turning now from the transmitter to the transmitting medium, the necessity for a reflecting or refracting outer atmosphere was universally accepted in 1919. Its precise nature was unknown, but the observed effects showed that the reflecting properties were widely variable and, of course, uncontrollable. For wave-lengths above one thousand metres it was known that the semi-empirical Austin-Cohen formula, with two experimentally-determined constants, gave results to within the degree of accuracy to be expected under the circumstances.

The extended knowledge of the properties of waves shorter than one hundred metres has, however, brought to light several new facts—in particular, the phenomena of "skip distance." Observation of slow and rapid variations of signal strength on the broadcasting bands of wave-length from 300 to 500 metres shows that even at these frequencies the waves reaching receivers at distances of no more than 100 miles are by no means the simple approximately plane waves commonly assumed. Wireless direction-finding experience confirms this conclusion.

According to the present theory, the "Heaviside Layer" is no longer in any sense of the word a "layer"—it now embraces all the space surrounding the earth where there are free electrons, and where the rarefaction of the gases of the atmosphere is sufficient for those electrons to have a mean free path of at least a few centimetres. This condition appears to be gradually attained at a height of about 50 kilometres, but the distribution of the electronic clouds and their origin is still a matter for speculation. The observed variation of the signals indicates that these clouds are subject to more or less regular changes throughout the day and throughout the year, but that there are, in addition, irregular and unpredictable changes frequently taking place, attributable to sunspots and other extra-terrestrial phenomena. The refraction brought about by the electronic clouds requires that the upper parts of a wave front should have a higher velocity than the lower ones. The part played by the electrons in causing this higher velocity is interesting and can be seen by considering the instantaneous conditions prevailing in a plane electromagnetic wave as shown in fig. 3. The vertical lines represent the electric flux density, and the circles with dots and crosses represent the magnetic flux density; these two being mutually at right angles and perpendicular to the direction of propagation. The sine curve shows the variation of magnitude of the two flux densities from point to point. The rate of change of the electric flux is shown by the small arrows along the curve, and this is—by Maxwell's famous assumption—equivalent to a current. As such, it is the source of the magnetic flux of the wave which, advancing with the velocity of propagation, is in turn the cause of the induced e.m.f. necessary for the maintenance of the electric flux. When a wave such as that shown in the diagram penetrates a space in which there are electric charges, these will be subject to forces tending to move them in the direction of the field. If these charges are free to move, they will do so and will give rise to actual

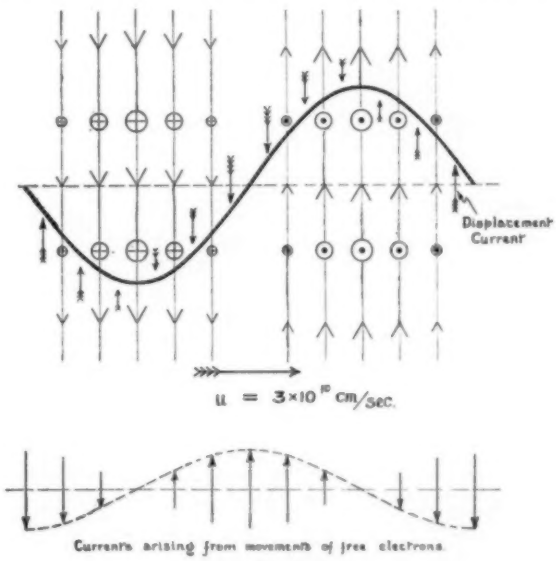


Fig. 3.

currents of electricity. Assuming the charges to consist of ions and electrons unimpeded by other molecules, the maximum velocities will be attained at points where the electric field has been acting in one direction for the longest time, as, for example, at the mid point of curve in fig. 3. At this point positive ions would be moving upwards and electrons would be moving downwards—the effect being that of a current in the *upward* direction. The equivalent current due to rate of change of the electric flux is, however, *downward* at this point. The fact of these two currents being in the opposite direction means that the magnetic effect due to the latter is to some extent neutralised, and the only condition under which the weaker magnetic flux can give rise to the same electromotive force is that it shall be advancing with a greater velocity. This increase of velocity will depend upon the number of ions and electrons per unit volume, their mass and the time that is available for accelerating them in one direction or the other, *i.e.*, the time for one half-cycle. The light electrons will obviously move more freely, and it is now believed that they are responsible for almost the whole of the refraction. The velocity acquired per half-cycle will be less and less as the frequency of the wave increases, and consequently it is to be expected that the refraction of the waves will get less and less as the wave-length falls. Actually the conditions prevailing over the surface of the earth are complicated by the presence of the earth's magnetic field, which has an appreciable influence in that it causes the electrons to follow spiral-like paths instead of straight ones. With wave-lengths above 500 metres this influence is not serious. Below 100 metres it leads to a less rapid reduction of the index of refraction than would be expected if it were neglected. For each value of the strength of the earth's field there is a particular frequency with which—owing to their thermal movements—the electrons will be spiralling round the lines of force of the earth's field. This frequency

is about the same over most of the earth's surface, and is approximately 1¼ million. For a wave-length of 200 metres—corresponding to this frequency—there is thus a kind of resonance which marks the change from the law of variation of index of refraction applicable to long waves to that applicable to short waves. Some wastage of energy must necessarily accompany the passage of an electromagnetic wave through electronic clouds owing to the additional collisions between electrons and molecules caused by the added velocities imparted to the electrons. But in the upper zones of the atmosphere where the mean free paths are considerable, the loss is negligible. Far more important is the question of the refraction of some portion of the wave away into space in the same way that a ray of light from the bottom of a pond is partly refracted into the surrounding air and partly reflected back into the pond when it strikes the underneath side of the surface of the water. There is some doubt as to the extent to which this action takes place. If it does take place at all, it is in the early stages of the refractive process and is dependent upon the polarisation of the wave. It is possible that the experiments now being conducted with horizontally-radiating aerials may throw some light on this problem.

(To be continued.)

Electrical Window Displays.

By G. C. HADFIELD, Showroom Manager, Southport Electricity Department.

WHILE publicity is given to all phases of electrical progress and activities (particularly to the means of selling domestic electrical appliances) through the medium of the ELECTRICAL REVIEW, I consider that the best channel for creating such sales is often sadly overlooked, if not lost sight of altogether. I refer to the retailers' or supply authorities' showroom windows, and, from experience, I estimate that approximately 50 per cent. of sales effected is influenced in the first place by window displays. The individual responsible for such displays is more or less handicapped because of the fact that he has actually only four distinct subjects to work upon, namely, lighting, heating, cooking, and power. True there are numerous variations of these subjects, but, nevertheless, he will have to exercise all the ingenuity he possesses if he wishes to prevent his efforts from falling flat.

Of course, there are many ideas on the question of window dressing, all of which are more or less good, but the really successful type of window must have one very essential feature. It must create interest. To this end it is necessary to dispense with the rather common practice of filling window spaces with all kinds of electrical "junk" and to get down

Fig. 1.—Southport Showroom Window—Exterior.

to "stunts." There are two classes of "stunt" windows—the one simple in layout, requiring no special "scenery" or stage effect, the other (as practised by most of the larger emporiums) very elaborate, very beautiful but, unfortunately, very costly. As each class of "stunt" is more or less equally effective from an interest-promoting and sales-getting point of view, it is advisable to confine activities strictly to the former as, otherwise, overhead charges will soar to such an alarming height that the display ceases to be a commercial proposition.

I have recently carried out a window scheme which has proved a huge success and, as a matter of interest to others, I include herewith photographs showing the simplicity of the actual layout. Unfortunately, the photographs are rather small, and consequently a detailed description of the setting will be necessary.

Description.

Exterior (Fig. 1).—The whole of the window glass was covered on the inside with black paper and, at a height of about six feet the following query was cut out of the paper and the stencil covered from the inside with white paper "? Isn't it amazing?" Immediately underneath were six slits or peep-holes, some 12 inches long by six inches wide. Suitable lighting from the interior of the window turned the stencilled query from a perfectly good "day" sign into an equally good night sign. As there is a certain amount of curiosity in almost everybody's make-up, the result was a foregone conclusion. Passers-by simply had to stop to see *what* it was that was so amazing.

Interior (Fig. 2).—The whole of the window bottom was covered with white glazed paper and in the centre was placed an ordinary household spring balance with a circular scale and pointer. Upon the weighing pan of the balance was one piece of coal weighing exactly seven pounds—the scale and the pointer giving absolute and irrefutable proof of the fact.

Fig. 2.—Southport Showroom Window—Interior.

Against this centre piece was a card which stated, "At four shillings per cwt. this small piece of coal costs 3d., whereas:—" Here a piece of red ribbon carried the observer's eye to the left of the window where an electric "coal" fire of well-known make was blazing away merrily, and a second card, which was attached to the other end of the ribbon, stated, "This electric fire can be used for a full hour for the same cost and:—" To the right of the window was an ordinary drawing-room coal-fire grate, containing the cinders, ashes and dust of a dead fire. On one side of this grate was a collection of all the necessary cleaning tackle, such as metal polish, black lead, brushes and dusters. On the other side of the grate were a bucket of coal, a coal shovel, an axe, wood-chips, paper, and matches. Amongst the cinders and ashes was placed a third card (connected in turn by a red ribbon with card No. 2) which, completing the message, stated "there is none of this kind of thing."

Other cards used were:—(1) Against electric fire, "No Smoke, No Smell, No Dirt, No Labour"; (2) against electric fire, "Just Switch On, That's All"; (3) against coal bucket, "This has to be Carried"; (4) against cleaning tackle "These all Cost Money"; (5) against coal grate, "Do you know that it costs you at least 4½d. to light a coal fire and you have to *wait* for the heat."

I hope that this description will be of interest and service to readers of the ELECTRICAL REVIEW.

American Municipal Utilities and Rate Relief.—The following extract from the *Electrical World* is of interest as showing an American view of the practice of aiding rates from the profits of municipal electricity undertakings:—"Substantial reductions in rates for the municipally-owned electric light plants at Anderson and Logansport, Ind., have been ordered by the Public Service Commission of that State. In these orders the Commission took a definite stand to the effect that municipally-operated lighting plants should not by means of high rates create surpluses which could be transferred to the city's general fund for the benefit of taxpayers. 'Creating a surplus should be stopped, and this Commission will not knowingly authorise a rate that will permit such practice,' the order in the Anderson case read. 'The Commission suggests that the time has come for the city officials to make tax levies sufficient to care for all municipal purposes.' The Anderson reduction in electric lighting rates will amount to about 20 per cent. The rate to domestic users was reduced from 6.48 cents to 5.18 cents a kilowatt-hour."

Electrical Gifts for Christmas.—II.

LAST week we commenced a series of suggestions for Christmas gifts, and since then have received particulars of further appliances which are eminently suitable for the purpose. A selection of these is made below. Several of the leading manufacturers have produced special booklets dealing with this subject, and these, combined with appropriate window displays, should enable retailers to do a good deal of business in this direction. The mention of window displays prompts us to draw attention to Mr. Hadfield's article which appears in this issue. The example of window display which he deals with may stimulate the imagination of those who are interested in the matter.

The General Electric Co., Ltd., has, as usual, a large variety of appliances suitable for presentation at Christmas. From these we have selected three devices. The first is a massage vibrator set (fig. 12), which is claimed to stimulate the nerves and aid blood circulation in the parts to which it is applied. A switch is conveniently fitted in the handle of the appliance. Another "Magnet" device is the hair dryer shown in fig. 14. In the orifice of this is a small heating element which can be switched on and off independently of the blower to enable either hot or cold air to be obtained. Fig. 15 depicts a rather novel fitting which should find its best application in a nursery. It consists of an "Osglim" neon lamp mounted on an ornamental standard supported by a miniature pierrette.

Fig. 10.—A "Jackson" Breakfast Cooker.

Fig. 11.—An Engine Warmer.

Fig. 12.—A Massage Vibrator Set.

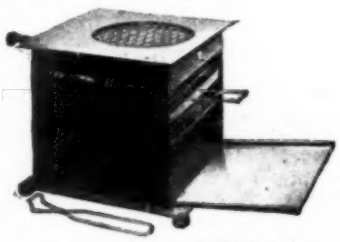


Fig. 13.—A "Cosmos" Table Cooker.

Fig. 14.—A "Magnet" Hair Dryer.

Fig. 15.—An "Osglim" Standard.

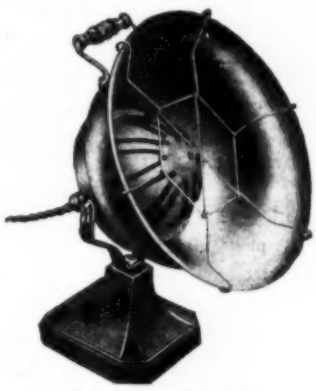


Fig. 16.—The "Halo" Fire.

Fig. 17.—The "Adapta" Fire.

Fig. 18.—The "Secura" Boiling Plate.

Fig. 19.—A Statuette Fitting.

Fig. 20.—The "Anchorlite" Fitting.

The "Adapta" fire illustrated in fig. 17 (Messrs. H. W. Sullivan, Ltd.) is a novel appliance and would form a useful present. Ordinarily the element (750 W) directs its heat outwards, but if it is desired to boil a kettle or perform minor cooking operations, the element can be put into a horizontal position under the top plate by means of a little lever at the side. Another Sullivan product is the "Secura" boiling plate (fig. 18). This has a height of 6¼ in., and the top plate is 11 in. square. The element can be of either 750- or 1,000-W loading, and it is controlled by a "footpress" switch. The appliance is finished in black enamel.

A very neat fire of the bowl type is the "Halo" fire, illustrated in fig. 16, which is made by the Arora Co. As will be seen, the coiled element is fitted upon a hemispherical boss, which, in turn, is mounted in a bowl shaped something like a shallow bell. The bowl is, as usual, of copper, and the pedestal is of cast iron with a matt black finish. The loading can be either 750 or 1,000 W; the bowl has a diameter of 11 in.; and the weight of the fire is 6 lb.

The next three suggestions are from a catalogue of Christmas gifts issued by Metro-Vick Supplies, Ltd. The first (fig. 19) is a handsome table standard of the statuette type ("Le Jour"). This has a height of 24 in., and is equipped with a handsome silk shade. Fig. 11 shows a handy device for warming automobile engines prior to starting; it has a low loading, 200 W, but is quite adequate for the purpose. The other "Cosmos" appliance is a useful little table cooker (fig. 13), which combines a grill and toaster. It is produced with either a stoved black or a nickel-plate finish, and has a loading of 1,000 W.

The breakfast cooker shown in fig. 10 (Jackson Electric Stove Co., Ltd.) is a convenient little appliance capable of performing quite a number of cooking operations. The element is fitted in the top plate and is controlled by a three-heat snap switch fitted upon a small chamber at the side of the appliance. The loading is 1,800 W, which is quite adequate for a cooker this size.

Fig. 20 depicts a very useful appliance for local illumination, such as for reading purposes. It is the "Anchorlite" fitting supplied by the Sloan Electrical Co., Ltd. Upon an ornamented leather band, weighted at both ends, is mounted a lampholder and shade, which can be adjustable or not as desired. The lamp fitting can be obtained with a gilt or an oxydised silver finish.

The Cardiff Engineering Exhibition.

COINCIDING with the virtual end of the coal dispute, the Engineering Exhibition at Cardiff, organised by the South Wales Institute of Engineers, comes at an opportune time. An excellent display by many leading engineering companies has been brought together in the somewhat confined space of the Cardiff Drill Hall. The organisers would have no difficulty in filling a building twice the size of the present one—if it were available. The exhibition was opened on November 26th, and remains open until to-morrow (Saturday). We give below some details of the exhibits, a large proportion of which were electrical.

The GENERAL ELECTRIC CO., LTD., makes a first appearance with one of the largest stands, upon which a number of its machines are exhibited. A great deal of the plant shown is for use in mines, and demonstrates the company's capabilities in this direction. The electrical part of the equipment was made at the company's Witton works, and the mechanical part at the Fraser & Chalmers Engineering Works, Erith. Examples of flame-proof colliery switchgear are shown. Among these is an oil-immersed draw-out pedestal type circuit breaker which is readily adaptable and suitable for distribution circuits above or below ground. A panel built up of similar units but without the flame-proof feature is exhibited; this is designed for use in non-explosive atmospheres. The carriage is withdrawn by means of a lead screw operated by a handle at the front of the circuit breaker. Another example of industrial switchgear on view is a pillar type motor-starting panel. This is made in sizes for motors up to 100 h.p., and from 100 to 400 h.p., to suit constant or variable speed machines. A typical G.E.C. cubicle which is shown is of all-steel construction. The draw-out portion consists of a stove-enamelled 4-in. steel panel. The oil circuit-breaker, transformers, relays, and measuring instruments are mounted on the truck, while the plug isolating switches are accommodated on a steel panel at the rear of the truck. The gear is fully interlocked to prevent accident and incorrect operation. A flame-proof oil-immersed rotor starter is exhibited. This is for use in fiery mines, and is made in five sizes. A cable box is fitted. This starter can be combined with an oil-circuit breaker to form a compiete control unit. Among the motors displayed is the "All-Watt Witton" machine. This works over its normal range at unity power factor, this result being achieved by providing the ordinary motor with an exciting device consisting of a commutator connected to a low-voltage winding. Motor combinations shown include a 10-cwt. spur-geared winch coupled to a protected-type 400-V motor; and a Witton-Kramer friction hoist for belt or direct coupling. Other exhibits were steam turbine and turbo-compressor wheels; a portable conveyor; vibrating screens for coal, gravel, &c.; and exhibits relating to "Holbeck" and "Bettington" coal pulverisers.

Another large stand is that of the ENGLISH ELECTRIC CO., LTD., and a number of the company's products are represented. Examples of industrial and mining type motors are on view, including a 95-h.p., 415-V, 3-phase haulage motor. This is a protected motor with colliery type slipring covers. The switchgear section includes an e.h.p. truck-type oil-immersed equipment for 200 A at 6,600 V, 3-phase. This is made in standard sizes up to 400 A at 13,000 V, with a maximum rupturing capacity of 250,000 kVA. A 100-kVA induction regulator for a 16 000-kVA, 11,000-V, 3-phase feeder is shown. The company has supplied nearly 200 000 kVA of these appliances. Another exhibit is the core of a 50-kVA transformer, part of an order for Adelaide. The high-pressure winding of this is for 33,000 V or 66,000 V, and tapping switches are provided. Pole-type transformers for tapping 33,000-V overhead lines are shown; these are arranged to reduce the pressure to 415 V, and are of considerable interest at this time when rural distribution is much to the fore. The English Electric steam turbine is represented by a 3,000-r.p.m. low-pressure wheel (complete), a governor, an auxiliary oil pump, and a number of finished turbine blades. As an example of the company's traction equipment there is shown a tramway type controller of the latest pattern. The company has supplied many large winders in the South Wales coal area. Upon the stand is a cabinet containing 256 photographs of the company's products. Siemens's "Zed" fuses are shown upon a board, and another "Siemens" exhibit is a special 1,500 V main fuse box for an electric locomotive, fitted with "Zed" fuses.

MESSRS. MAVOR & COULSON, LTD., again show examples of their coal-cutting machines, which are adaptable to electric or compressed air motor drive. The "Samson" cutter shown is the company's latest model. As exhibited it is fitted with a compressed air motor, but it is equally suitable for electrical operation. The machine is arranged to cut at floor level to a depth of 4 ft. 6 in. by means of a toothed chain. An electrically-driven universal chain-type coal cutter is also shown. This is equipped with a 3-phase electric motor, and can cut at floor level to a depth of four feet. It can be converted into a bar-type machine or adapted for compressed air operation. Another exhibit is one of these machines fitted with a bar cutter.

The stand of the HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD., is shared with three associated companies. The exhibits of the Hackbridge Co. comprise a 100-kVA, 3-phase mining type transformer tank; various small transformers and assembly details; voltage-regulating equipment; and an 825-kVA, 50-cycle rotary converter transformer. One transformer shown on the stand is a special 3-phase—12-phase transformer with a tapping switch on the h.p. side. This is used in connection with the exhibit of the HEWITTIC ELECTRIC CO., LTD., and is connected up to two mercury-vapour rectifying bulbs, each having six "burners." These are arranged, with the necessary instruments and switchgear, in two cubicles on the stand. Examples of small medical and battery charging rectifiers are shown, as well as quartz ware for mercury-vapour rectifiers and tubes for photographic work. The stand is illuminated by means of the Hewittic "Servicelight," a mercury-vapour system with a consumption of 0.33 W per candle power. Other exhibits are a "Hewitt-Levick" "Ulviarc" lamp for ultra-violet ray treatment and an "Ulviarc" laboratory outfit for use as a fadometer, for spectroscopic work, and all types of industrial chemical work.

The NEW SWITCHGEAR CONSTRUCTION CO., LTD., also shows upon this stand a transformer kiosk. This has three compartments, the largest, central, one housing a 300-kVA transformer. One side compartment contains the h.p. gear comprising an oil switch and isolators, the other side being allocated to the l.p. gear and distributors. This company also exhibits a 6,600-V draw-out truck type cubicle which is thoroughly interlocked. On the same stand Messrs. Sheppard & Sons, Ltd., show a model and sections of their coal-washing plant.

Another composite stand is that of MESSRS. HASLAM AND STRETTON, LTD., Cardiff. One section of this was devoted to "Thor" lamps and accessories. For the first time a miner's safety lamp fitted with Dr. Thornton's gas-detecting device is shown. This consists of a small gauze chamber in which is placed a thermo-couple of platinum alloy and another metal specially susceptible to heat. Any rise of gas content causes the thermo-couple to operate and switch on the lamp. The gas percentage at which the device acts is arranged for by an adjustable collar. The light is similarly extinguished when the gas percentage falls. A feature of the charging rack shown is a moulded lug at each position. A corresponding opening in the base of the lamp fits over this and prevents the lamp being inserted the wrong way. The charging board is fitted with circuit breakers instead of fuses and a gravity operated resistance cut-out. A new self-contained magnet for opening lamps is shown. Another section of the stand is devoted to Reyrol'e gear. This includes a draw-out gate-end switch rated at 100 A and 660 V, three-phase. The switch is provided with overload and core balance leakage protection, and the plug is electrically interlocked so that it cannot be withdrawn without tripping the switch. A break in the earth connection also causes the switch to operate. Examples are shown of the new standard mining plugs. Other types of gate-end switches are on view, and a part of the exhibit consists of a number of porcelain-handle fuses, and domestic and industrial wall-plugs. Another company represented by Messrs. Haslam & Stretton is MESSRS. Evershed & Vignoles, Ltd. This display comprises a full range of equipment for measuring resistance, and includes the "Megger," "Meg," and "Ducter" instruments. The company's sub-station recorder is exhibited. This is designed to register the position of distant switches, levers, &c., and to show whether machines are running or not. The equipment is made in three types, with 7, 12 or 30 movements all indicating on a single chart. "Arca" regulators are exhibited on Messrs. Haslam and Stretton's stand. These are for controlling any physical condition such as pressure, temperature or humidity, and can be made to operate through electrical relays. The company also represents FILTRATORS, LTD., and the De Laval oil and water purification equipment, and examples are shown.

The ELECTRIC CONSTRUCTION CO., LTD., has as its main exhibit a 250-b.h.p., 3,300-V, 3-phase induction motor, which has been sold to the Channel Dry Dock Co. for driving the main pumps at the Parry Graving Dock. A rotor starter for this motor is also shown. Other types of motors are included in the exhibit, as well as a totally-enclosed d.c. motor starter. One device shown is a plate-type vent for colliery motors and switchgear.

As at previous exhibitions, MESSRS. GENT & CO., LTD., have a comprehensive display of their products. These include "Tangent" mining flame-proof bells, relays, and keys. Signalling apparatus of various kinds is on view. The company's staff locater, which is installed in works to call any official who may be required at the office by visible and audible signals, has been improved by the addition of a new type of transmitter. This consists of a dial upon which a pointer is fitted. The latter is turned by means of a central knob, which, when pressed, actuates the signals. The firm's "Pulsynetic" time keeping system is again shown, and dials above the gallery are controlled by a master clock upon the stand. Other appliances shown are water-level indicators and recorders, motor sirens, &c. The company's radio business continues to make progress, and is well represented. The latest productions are a new type of headphone with beautifully-moulded ear pieces, and a high-tension battery eliminator for connecting to mains, fitted with a special

"Mullard" rectifying valve. Audio-frequency transformers and coils are displayed, as well as examples of the "Touch-tone" cabinet-type loud speaker.

On the stand of MESSRS. HONEYWOODS (SUPPLIES), LTD., are examples of Ransomes motors; an A.E.G. CO_2 recorder; a Wilton furnace front and bed; and a Johnson & Phillips switch. The last is a heavy oil switch designed for use in fiery mines.

The exhibits of Messrs. C. A. PARSONS & CO., LTD., include an oil-cooled single-phase transformer fitted with a tapping switch; it is rated at 270 kVA, 5,500/508 V, 40 cycles. The steam plant shown comprises a steam-jet vacuum pump for the condensing plant of a 5,000-kW turbo-alternator; an early Parsons turbo-dynamo with a capacity of only 0.5 kW and a speed of 9,000 r.p.m.; and turbine and alternator parts. Another exhibit is the company's split searchlight reflector enabling a dispersed beam to be obtained with a dark space in the centre.

Messrs. W. H. ALLEN, SONS & CO., LTD., exhibit models of a 45,000-sq. ft. surface condenser, and a bore-hole pump, as well as samples of turbine blading and a typical stainless-steel wheel from an Allen impulse turbine. Numerous photographs of large condenser and turbo-alternator installations decorate the stand. An exhibit of historical interest is a Kapp 135-V, 27-A dynamo constructed in 1887.

The CATTLEY ACCUMULATOR CO., LTD., is showing a new secondary cell which is claimed to possess many points of superiority over the older types. The accumulator contains a specially-constructed porous plate of a brick-like uniform composition as opposed to the usual grid and paste construction. The company claims that the accumulator can be consistently ill-treated and even short-circuited without sustaining any damage. It is also claimed that the construction of the negative plate renders it immune from buckling and sulphation. Upon the same stand the MIDGET LAMP CO. (1924), LTD., shows examples of its bulbs for miners' lamps, in connection with Cattley cells.

The BRITISH FLOTTMAN DRILL CO., LTD., includes in its display an electric mine car air compressor, with a capacity of 90 cu. ft. of free air per minute at 80 lb. per sq. in.

Messrs. THOS. WARD, LTD., show electrically- and mechanically-driven pumps, a Peter Brotherhood steam engine coupled to a 25-kW Laurence Scott generator, running at 500 r.p.m., and an electrically-driven worm reduction gear (motor by Laurence Scott & Co.).

Many examples of its accumulators for radio and mining use are exhibited by the OLDHAM ACCUMULATOR CO., LTD. In addition, miners' lamps and charging equipment are shown. One of the latest accumulators is a snap-lid pattern, which is interchangeable with three types of miners' lamps.

INTERNATIONAL COMBUSTION, LTD., displays in operation the "Hum-mer" electrically-driven screen for separating materials, as, for instance, sorting coal. It consists of a tightly-stretched wire screen, the frame of which is made to reciprocate at 1,800 impulses per minute by means of a powerful electro-magnet.

Messrs. ANDERSON, BOYES & CO., LTD., show examples of their coal-cutting machines. Among these are an "A.B." 17-in. chain cutter driven by an electric motor, and a smaller machine of the same type operated by compressed air. The machines are exhibited together to show their adaptability to either form of drive. Another exhibit is an arcwall cutter operated electrically; this can also be driven by compressed air if desired.

Mr. FRED. S. CARTER represents four firms, and displays examples of their productions. Those of the KEY ENGINEERING CO., LTD., consist of a steam trap of simple construction, sections of fibre conduit for underground cables, and fibre bird guards for overhead lines. NEW ALLDAYS & ONIONS, LTD., show electrically-driven fans for blacksmiths' hearths, &c. Messrs. VLASTO, CLARKE & WATSON'S exhibits are a horizontal flameproof oil-immersed motor controller; a star-delta starter with a new type of no-volt release, consisting of a laminated keeper and magnet coils; and a three-pole contactor. Examples of "Aeroflex" heavy-duty fuses form the display of Messrs. PARMITER, HOPE & SUGDEN, LTD. A notable exhibit is a fuse blown by a dead short-circuit on the power-station battery of the Bradford Corporation. The oscillograph record gave a current reading of 29,000 A, and the fuse opened circuit in .075 second. Boards built up with "Fluvent" and "Aeroflex" fuses are shown.

The WOLF SAFETY LAMP CO., LTD., shows a number of miners' lamps of various types—mainly with nickel-cadmium (alkaline) accumulators. Some of these are fitted with the Thornton gas-detecting device previously mentioned. The centre contact of the accumulators prevents their being reversed when placed on the charging rack. A charging rack shown is of a convenient pattern, the lamps being hung upon it instead of standing upon shelves. Other exhibits of the company are a violet-ray lamp and the "Adaptalite" electric lamp fitting. This is fitted with a reflector and is described by its name.

The following are also exhibitors:—FILM COOLING TOWERS, LTD. (a model cooling tower); the CROSTHWAITE ENGINEERING & FURNACE CO., LTD. (a small furnace for low-grade fuels and a self-cleaning grate for a Lancashire boiler); Messrs. ED. BENNIS & CO., LTD. (working chain-grate stoker, six-speed drive, with coal elevator); Messrs. BROOM & WADE, LTD. (air compressors); the USKSIDE ENGINEERING CO., LTD. (electrically-driven 10-h.p. main and tail haulage); Messrs. J. SHAW, SON & GREENHALGH, LTD. (steam fittings of many kinds, including h.p. boiler mountings, slide valves, stop valves, &c.); and Messrs. W. B. DICK & CO., LTD. "Ilo" lubricating oils and greases.

The lighting of the hall and stands was carried out by Messrs. Page & Stibbs, Cardiff.

The Electricity (Supply) Bill.—II.

Proceedings in the House of Lords.

ON November 23rd, LORD PEEL moved the second reading in the House of Lords of the Electricity (Supply) Bill. He explained that the object of the Bill was to secure the production of electrical power on the largest possible scale at the lowest possible price in this country. The method by which this end would be attained was as follows:—All h.p. electricity generated by authorised undertakers in this country was in due course to be generated under control in accordance with a technical scheme for the whole country, and sold through a Central Electricity Board to authorised undertakers themselves. The Bill did not deal with the distribution of electrical power. The justification for the Bill was that, while electricity was becoming more and more the motive power for industry, Great Britain was falling behind her industrial competitors. The figures on which the Bill was based had been very carefully examined, tested, and re-tested by the Electricity Commissioners and a number of outside experts. The introduction of the Bill was justified on three grounds:—First, because we were behind our competitors at the present moment; secondly, because we were not progressing at the same rate as other countries; and thirdly, because, although there was development in our electrical generation, it was on the old uneconomical and wasteful lines. In trying to remedy the existing state of things, it was abundantly clear that the policy of persuasion had failed. The present system was permeated with the old parochial feeling, complicated by a large amount of healthy competition or distrust and jealousy between the local authorities and the power companies. If we could sweep away the whole of our existing installations and start afresh with our present knowledge, undoubtedly Great Britain would be treated as a single unit. But, if the industry was allowed to remain as it was, progress towards something approaching that ideal would be very slow. The point was not so much whether the ideal could ultimately be reached, but how did Great Britain stand in relation to other countries from the point of view of progress? The capacity of authorised undertakers in this country had increased from 2,500,000 kW to 4,750,000 kW during the last six years, and the annual average rate of increase of consumption had been 14 per cent., which compared with Germany's 25 per cent. per annum and Italy's 38 per cent. per annum between the years 1921 and 1925. In the last two years some £33,000,000 of new capital had been invested in the electrical industry. It was significant to note that in the one month of January, 1926, in America, no fewer than 168 million dollars was invested in new electric light and power companies, or about the same sum as was invested in Great Britain in 24 months. We were not progressing more rapidly than other nations; we were falling behind. Moreover, while our progress was largely upon the old lines, other nations were reorganising their systems. The Government realised that existing conditions must be taken into account, and existing rights safeguarded as far as possible. The Bill was founded on three principles: The minimum of State control, the minimum of State interference, and the allowance of a maximum freedom to existing undertakers. The Government hoped that there would be co-operation between the owners of the selected stations and the Board, and that the compulsory powers provided in the Bill would never be required.

LORD HALDANE, on behalf of the Labour peers, strongly supported the Bill. It was not only economical and safe financially, but was calculated to give great profit to those who generated electricity.

LORD WEIR, the chairman of the Weir Committee, declared that the problem of our national productivity could be fairly measured by the rate of energy consumption in the form of heat, light, and power. The review made by the Weir Committee disclosed that our country possessed assets which, if properly utilised and co-ordinated, could yield

a supply of electrical energy at costs so favourable as to confer on the industries of the country a competitive advantage over other countries, except where an industry could be located in the closest proximity to readily-available water power. The Committee was impressed by the fact that all evidence and investigation disclosed beyond reasonable doubt that in this country we were neither generating, transmitting, nor distributing electrical energy as cheaply as we might, nor were we consuming electrical energy to anything like the same extent as other highly-civilised industrial countries. The electrical legislation of the past had contributed substantially to place us where we were to-day, and only through new legislation should we be able to repair the situation. This country was a pioneer in electrical development, but we also pioneered electrical legislation which had not proved to be so creditable. We granted independent supply rights in large numbers both to private enterprise and to municipalities, but we made no effective provision for co-ordination, and through lack of this our system had come in direct conflict with the technical and commercial considerations which more mature knowledge had shown to be essential for the cheap and effective generation and transmission of h.p. energy. The 1919 Bill made an effort to secure this co-ordination by suasion and voluntary co-operation, but there was ample and saddening evidence of the failure of that form of effort. The whole trend of development of electrical supply in every country was towards interconnection. Accordingly, the Weir Committee came to the conclusion that interconnection must be the foundation of the scheme and that the essential compulsory co-ordination of existing monopolies in generation could be most practically achieved through the organisation which owned and operated the transmission grid, and accordingly for this purpose the Central Board was proposed. If, in the past, the sub-divided supply rights had been given in every case to private enterprise instead of to municipalities and private enterprise, the essential co-ordination and combination would almost certainly have taken place as a matter of commercial evolution. The supply rights would have become merged, inter-connection arrangements would have been made, and to-day our problem would certainly not have existed in the form in which it did. An alternative to the Board would have been the Commissioners themselves, but if this course were adopted, the country would lose its national judicial electrical authority, and would then have a real example of State Department operation of a public utility. Criticism had been directed against the proposed Board's power to control the operation of selected generating stations. That control was essential to secure economy and was inherent to the operation of a large transmission system, but in its application it was neither interfering nor exigent. The Board would be responsible for the supply of high-pressure energy in Great Britain and for its cost, and it would not be able to relieve itself of that responsibility by passing the load on to anyone else. In regard to the standardisation of frequency, the Weir Committee believed the present non-standard system was defective. The Bill would give the Board power to standardise, and would give it finance to carry that out. He did not propose to move an amendment for instructing the Board to standardise, but he wished to record his definite opinion that the Board should make the standardisation decision at the earliest possible moment and cure the evil before it became chronic. The distribution authorities were at present hampered by petty restrictions: One which the present Bill dealt with was the removal of restrictions on municipalities in regard to the sale of appliances. Apart altogether from legislation, the Committee felt that the main elements in the existing high cost of distribution arose from the relatively small consumption of electricity. That was largely due to a lack of selling enterprise on the part of the distribution authorities. As to the reaction of the new proposals on the electrification of our British railway system, before the Central Board adopted any of the schemes prepared by the Commissioners, in fact, in the preparation of those schemes, he hoped that the possible electrification of main lines would be kept constantly in view. If capital outlay were the main obstacle to railway electrification, then that obstacle could be greatly ameliorated by a transmission lay-out which, from the beginning, envisaged a railway demand for energy, and few railways in the world would be able to secure their energy supply so cheaply as a British railway under this scheme. He was personally convinced that the future prosperity of this country was bound up with the problem of the effective conversion of our great fuel resources into electrical energy, into gas, and into liquid hydrocarbons. The gravest economic danger signal in sight was the fall of our export of thermal units in the form of coal and the ever-increasing imports of thermal units in the form of oil and motor spirit. To-day, if anyone produced cheap electrical energy from waste heat or as part of a carbonisation plant output, there was no free market for that product. The grid would provide the market for electrical energy which could be produced by more economic processes than those which obtained in the best power stations of to-day. Because he had the most earnest faith in the future of our country's industries and of our people, the necessity for the Bill seemed overwhelming.

LORD BANBURY strongly opposed the Bill, and said that the railways were not in a good financial position, and if huge sums were to be spent on electrifying the main lines they would probably be found to be nearer bankruptcy than anything else. The Bill was nothing more or less than disguised confiscation.

LORD RAYLEIGH argued that electrical engineers were convinced that interconnection was the only system by which the present position of chaos could be improved.

The debate was then adjourned.

On November 24th LORD FORRES who, as Sir A. Williamson, was chairman of the Williamson Committee, made a powerful speech in support of the Bill. He mentioned that in this country we had not done nearly as much as we ought in recommending the use of electricity for domestic and small power purposes, and it was very necessary, if we wanted a cheap supply of electricity, that we should all be propagandists for its use. The Bill would give a considerable impulse to the industry, and would undoubtedly facilitate the supply of electrical energy to the railways. He agreed that the Bill was not perfect, nor was it entirely logical, but it would do a great deal.

The Bill was then read a second time without a division.

LORD CARSON moved that the measure be referred to a Select Committee for further consideration. He disclaimed all idea of hostility to the Bill, and said his sole object was that they should have the best possible Bill after the fullest consideration by those in whose judgment they had confidence. He admitted that a great change was necessary and that drastic legislation had to come, but if ever there was a case in which a Select Committee of that House ought to take a hand it was that case. To say that in that House they could ever really thresh out that Bill in the ordinary course of a Committee stage was ridiculous. It was only playing at legislation. The evidence of the Weir Committee had never been published, and he was told that the representatives of electricity supply undertakings, with capital amounting to £194,000 invested in the electrical business, had been absolutely refused a hearing. These companies ought to be heard. The Bill, which conferred such enormous powers on a Board which was without precedent, ought to be submitted to a Committee which could go into it line by line, and see that, as far as possible, while the necessary powers were given by legislation, at the same time the existing interests of those who, on the faith of existing legislation, had invested money in those undertakings, should be protected.

LORD BIRKENHEAD acquitted Lord Carson of any attempt to wreck the Bill, but pointed out that his motion, if carried, would prevent the Bill becoming law this session. The Government would profoundly regret the delay involved in the appointment of a Select Committee.

Lord Haldane also opposed Lord Carson's motion, as did Lord Russell and Lord Montagu of Beaulieu. Lord Danesfoot and Lord Falmouth supported it. Lord Balfour made the final speech for the Government and, on a division, Lord Carson's motion was defeated by a majority of 81, or 104 votes to 23. The Bill was then committed to a committee of the whole House, which was to commence its sittings on Tuesday last.

The Radio Manufacturers' Association.

Constitution and Objects.

SINCE its inception at a joint meeting of members of the Manufacturers' Section of the N.A.R.M.A.T. and of the Society of Radio Manufacturers, held on September 6th, the Radio Manufacturers' Association has proceeded steadily to establish itself as a representative body. Already its members are more in number than those of the old N.A.R.M. when that association commenced operations. Pending the election of a representative Executive Council at the forthcoming first annual general meeting on December 8th, the functions of the Association have been carried on by an interim committee (composed of the old executives of the N.A.R.M.A.T. Manufacturers' Section and of the S.R.M.) brought into being in accordance with the regulations. The first act of this committee was the appointment of a working committee of eight members—since increased to 10—to attend to the preliminaries connected with the formation of the new Association. From the first it has been the object of the R.M.A. to give attention to the following matters:—(*a*) The determining of a policy regarding the holding of radio exhibitions in provincial centres; (*b*) the dealing with existing difficulties and restrictions affecting the British radio industry; (*c*) the promotion of close co-operation with the British Broadcasting Commission, the Press, radio distributors' organisations, and listeners' associations; (*d*) standardisation; and (*e*) the taking of the necessary steps to extend British radio export trade and, in this connection, to facilitate the showing of members' manufactures at foreign wireless exhibitions.

As to provincial exhibitions, the coming Executive Council will frame a policy, but as regards the London exhibition steps have already been taken to secure Olympia for 1927 and the four following years. As at present arranged, the 1927 exhibition will be held in the latter part of September next. With regard to standardisation, representatives of the

Association have been appointed to the B.E.S.A. Committee for the standardisation of valve holders, and the committee set up by the Institution of Electrical Engineers to deal with the issue of wiring regulations for battery eliminators in connection with h.t. supply from the mains for radio receiving apparatus. Referring to "price maintenance" (one of the objects of the R.M.A.), steps have been taken to secure certification as a trade union in order to put the Association in a position to deal with price-cutting.

While it is impossible to reproduce fully the regulations of the Association, it may be stated that the following matters are treated:—A "stop list" will be maintained by the Association; information regarding raw materials, markets and credits will be available to members; a benevolent fund is projected; wage negotiations will be carried out; arbitration machinery will be provided for members; and members will be prohibited from participating in exhibitions without the sanction of the Association. Membership is limited to individuals, companies and firms being: (*a*) Manufacturers of broadcast apparatus, the whole or greater part of whose manufacture is carried on in the United Kingdom and whose turnover is derived mainly from their manufacture of apparatus for sale in the open market; (*b*) Manufacturers of broadcast apparatus, the whole or greater part of whose manufacture is outside the United Kingdom, and whose turnover in broadcast apparatus in the United Kingdom is derived either wholly or mainly from their manufacture of apparatus for sale by them in the open market, provided that the approval of the Association be given in a particular instance or as a general rule; (*c*) Companies who are sole concessionaires as regards broadcast apparatus for, and are also substantially owned and controlled by, a company eligible under sub-clauses (*a*) or (*b*); or (*d*) Manufacturers of radio apparatus who do not come within any of the foregoing categories and whom the Association may approve for membership. A member shall not deal in any class of radio goods of foreign manufacture if similar goods are included in the official schedule which will be issued by the Association, except in (*a*) such cases where a member shall, in anticipation of manufacturing such goods in the United Kingdom, find it necessary to import the goods for a limited period; (*b*) such cases where a member, in order to obtain a concession to import such goods as last mentioned, may be compelled to import other goods for which he anticipates no sufficient market in this country to justify undertaking manufacture; or (*c*) such other cases as the Council may permit, provided that a member shall, in the case of (*a*) manufacture such goods in this country and entirely cease from importing them within 18 months; and in the case of (*b*) he shall within a like period cease to push the sale of such goods in any way. The fixing of retail prices and discounts and terms and conditions shall be the exclusive concern of the individual member. Such retail prices, &c., can be registered with the Association for protection. Liquidation, bankruptcy and similar acts shall terminate membership.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Turret Distributors.

With reference to the description of the German four-way plug-in die which we published in these columns of our November 26th issue, MESSRS. A. P. LUNDBERG & SONS, 477-489, Liverpool Road, Holloway, London, N.7, point out that they have made a similar device, the "Turret Distributor," since 1901. This device is made in several designs, from 2-way up to 6-way models.

An Infinitely Variable Speed Gear.

The P.I.V. (Positive Infinitely Variable) gear, fig. 1, is an invention which has recently been marketed by MESSRS. P.I.V. GEAR SYNDICATE, LTD., 7, Princes Street, Westminster, London, S.W.1. It enables, it is claimed, the speed ratio to be varied to an infinite degree, within the range of the gear supplied, between a driving and a driven shaft, smoothly, noiselessly, instantly, and with positive transmission, at any desired centres by the operation of a single handle or lever.

The essential principle of the device consists in the use of a chain of special construction, fig. 2, which runs between two expanding pulleys of the opposed conical-disk type, each sloping down at an angle of 30 deg. on the inner face. The pulleys contain alternate ribs and grooves radiating from the centre, which broaden out at the periphery, while the two halves are "staggered" in the sense that each rib on one is always opposite a groove on the other. The chain, which is thus engaged at its edges by the ribs, is formed of vertically-arranged and meshed links punched with longitudinal slots, and in each slot is a casing, open at each side, inside of which is placed vertically a pack of small thin steel plates. These are loose in that they are free to move in either direction at right angles to the travel of the chain. The plates project in turn from each side into the pulley grooves, and in running, as a link enters the "V" of the pulleys, the teeth of one push the requisite number of plates across into the groove of the other, so that the chain must always engage with the pulley faces. To ensure continuous and easy running the driving edges of the wheel teeth are not at right angles to the wheel faces, but inclined at an angle to prevent the possibility of half a plate being necessary to completely fill the groove.

In order to alter the speed of the driven shaft, it is only necessary to open or close slightly the halves of each of the

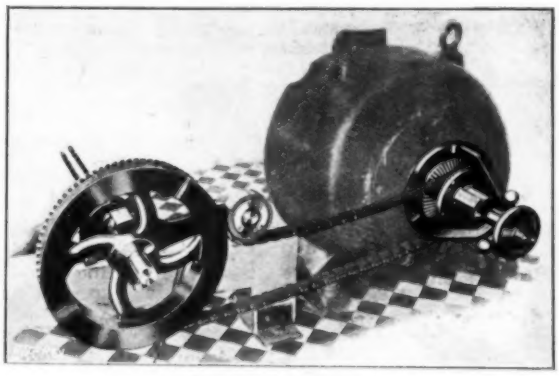


Fig. 1.—A "P.I.V." Drive.

expanding pulleys by means of the common lever, the chain opening out or closing in accordingly, giving the same effect of a larger or smaller pulley. The whole arrangement can be totally enclosed and run in oil, rendering it impervious to dust, gases, or other deleterious influences, or, alternatively, operated as an open drive with long centres. The smallest standard "P.I.V." gear is rated up to 5 h.p., and, with a driving-shaft speed of 750 r.p.m., allows an infinity of speed regulation on the driving shaft within the limits of 300 and

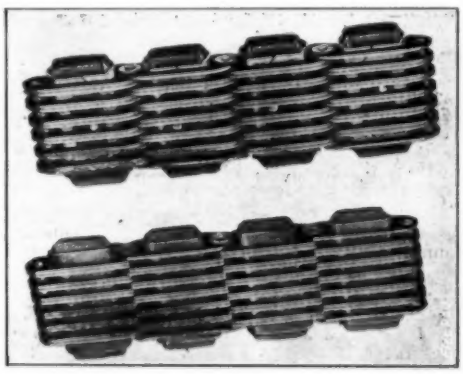


Fig. 2.—Construction of Chain, Front and Back.

1,800 r.p.m., the whole being contained in a closed box, 20¼ in. by 13¼ in. by 10 in. An a.c. motor running at 1,000 r.p.m. with an open chain drive allows of any speed variation being given to the driving shaft within the range of 250-500 r.p.m. National Physical Laboratory tests recently carried out on the equipment have given very satisfactory results; the 5-h.p. gear showed a transmission efficiency of 91 per cent. at 375 r.p.m., 1 : 2 ratio as compared with the driving shaft, and 87 per cent. at 1,500 r.p.m. or 2 : 1, while at even speeds of 750 r.p.m., 1 : 1, the figure is claimed to be 95 per cent.

An Automatic Arc Welder.

The new Westinghouse "Auto-Arc" is a machine for automatically feeding a continuous welding wire, used in metallic electrode welding, to the work at any speed up to 3 ft. per minute, which is necessary to maintain a constant arc length and a constant arc voltage. This machine strikes the arc automatically and, if necessary, will exert a pull of approximately two hundred pounds in order to prevent fusion of the electrode wire to the work. This device relieves the operator of the tiresome and exacting hand labour of maintaining the arc and feeding the welding wire, and the electrical conditions of the arc remaining practically constant, it is possible to secure a better weld and to deposit metal very much faster than can be done by hand welding. The equipment can be used to best advantage on work requiring the welding of long, continuous seams. The Cutler-Marsden automatic welder, which has similar qualities, was fully described in the ELECTRICAL REVIEW of December 12th, 1924.

A Floodlight Projector.

At the International Road Congress held recently in Milan considerable importance was attached to the report of the road-planning scheme, elaborated on his death bed by the late Chief Constable A. Bassom, with the co-operation of other

gentlemen. The scheme provides, among other proposals, for the lighting of streets at night by flood-lighting the buildings. The application of this principle, it is claimed, would ensure a much more uniform distribution of light throughout the length of the street than is possible with the present system, and would also increase considerably the safety and comfort of road users in general, by eliminating the deep shadows and glare frequently caused by powerful direct-lighting units. The flood-lighting system, correctly planned, would, no doubt, prove equal to the task of solving the many intricate problems associated with highway illumination, whilst possessing the undoubted advantage of dispensing with rows of street lamps.

Fig. 3.—Floodlight Projector.

It is interesting to note that the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2, has already designed and supplied a number of installations for the illumination by flood-lighting of roadways, railway sidings, and large open areas of every description. Fig. 3 shows one of the flood-light projectors designed by this firm which is in a position to give expert advice on the application of the system to meet the requirements of any situation.

A New V.I.R. Cable.

We have received from ELECTRIC CABLES, LTD., 88, Golden Lane, London, E.C.1, some samples of a new production, "Virclad" cable. In the manufacture of this cable the last two covering processes appear to be the reverse of what is the usual practice with ordinary v.i.r. cable. The outside is of the usual lower-grade rubber used for the outer insulation, but under this is the protective braiding. It is claimed that the braiding in this cable does not so readily absorb moisture, and that the cable is more easily drawn through conduits by virtue of the smooth surface of the outer covering.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 24th :—

Equi Cyclic. No. 469,857. Class 8. Electric condensers for use in radio-telegraphy and telephony.—Portable Utilities, Ltd., 8, Fisher Street, Southampton Row, W.C.2.

Talkativ. No. 472,879. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—H. P. Gibson, trading as Gibsons, Coromandel, Bellevue Road, Ryde, Isle of Wight.

Unlimitex. No. 473,830. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Wireless Supplies Unlimited, 81, Leyton Road, Stratford, E.15.

The Duophone. No. 473,598. Class 11. An apparatus for the use of deaf persons.—Stols Electrophone Co. (1914), Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925

14,572. "Apparatus for interrupting electrical circuits." Dubilier Condenser Co., Ltd. (in liquidation) (W. Dubilier). June 4th, 1925. (260,649.)

14,874. "Telegraph printers." Morkrum-Kleinschmidt Corporation. June 13th, 1924. (235,561.)

17,016. "Switch for the electrical circuits of wireless installations." R. G. Cronyn. July 2nd, 1925. (260,651.)

17,544. "Manufacture of electrical insulators and other moulded articles and the like." A. H. Brown and Siluminite Insulator Co., Ltd. July 8th, 1925. (260,653.)

17,547. "Automatic switches for use in telephone exchange systems." Standard Telephones and Cables, Ltd. (G. Deakin). July 8th, 1925. (260,654.)

18,998. "Winding of electrical coils." C. B. Kersting. July 27th, 1925. (260,659.)

19,217. "Electric terminals." H. J. Lee. July 29th, 1925. (260,660.)

19,467. "Amplifying means, particularly applicable to office or public line telephonic receivers." M. Graham, A. Graham (executors of E. A. Graham, deceased), and W. J. Rickets. July 31st, 1925. (260,663.)

19,656. "Inductance coils for use in wireless apparatus." Igranic Electric Co., Ltd., and A. H. Curtis. August 4th, 1925. (260,670.)

19,689. "Electric safety draw-bar lock for railway-carriage doors." J. F. Gleave. August 5th, 1925. (260,674.)

19,716. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 5th, 1925. (260,677.)

19,856. "Diaphragms for primary or secondary cells, electrolytic cells, filters, and the like." Dr. H. Beckmann. August 22nd, 1924. (238,870.)

20,171. "Apparatus for the generation of Röntgen rays." Dr. G. F. Du Prel. August 11th, 1925. (260,690.)

20,578. "Inductance coils." H. K. Whitehorn. August 17th, 1925. (260,698.)

20,734. "Ignition magnetos for internal-combustion engines." British Lighting and Ignition Co., Ltd., and J. C. Hutton. August 18th, 1925. (260,700.)

20,901. "Tuning devices for wireless circuits." Fuller's United Electric Works, Ltd., and A. P. Welch. August 20th, 1925. (260,701.)

21,205. "Electromagnetic sound-reproducing devices." Fuller's United Electric Works, Ltd., and A. P. Welch. August 24th, 1925. (260,702.)

21,283. "Electric circuit breaker systems." British Thomson-Houston Co., Ltd. August 25th, 1924. (238,907.)

22,310. "Induction coils." H. H. V. Harford. September 7th, 1925. (260,710.)

22,373. "Thermionic valve holders." T. Hough. September 8th, 1925. (260,711.)

22,470. "Electric storage batteries or accumulators." G. E. Webster. September 8th, 1925. (260,713.)

22,494. "Wall boxes for electric switches and the like." J. B. Tucker. September 9th, 1925. (260,714.)

22,607. "Construction of electric discharge tubes." General Electric Co., Ltd., and R. Le Rossignol. September 10th, 1925. (260,716.)

22,756. "Sound-amplifying means embodying wireless telephonic receivers." M. Graham and A. Graham (executors of E. A. Graham, deceased). September 11th, 1925. (260,717.)

23,166. "Electric lamps, such as automobile side lamps." Butlers, Ltd., and A. Reeves. September 17th, 1925. (260,723.)

23,888. "Electrical transformers." Igranic Electric Co., Ltd., and A. H. Curtis. September 24th, 1925. (260,731.)

23,954. "Electric condensers." British Thomson-Houston Co., Ltd., J. Griffiths, and C. J. Morton. September 25th, 1925. (260,733.)

23,985. "Aerials for use in wireless installations." P. Richardson. September 25th, 1925. (Cognate application 15,829/26. Addition to 216,657.) (260,734.)

24,412. "Synchronous telegraphic receiving or repeating systems." Western Union Telegraph Co. August 14th, 1925. (256,913.)

24,422. "High-tension or anode electric batteries." H. Oelze. September 30th, 1925. (260,736.)

25,361. "Sparking plugs." A.C. Sphinx Sparking Plug Co., Ltd., and D. H. Corbin. October 12th, 1925. (260,746.)

25,911. "Accumulator plates." W. Haddon. October 16th, 1925. (260,754.)

26,392. "Clutch mechanism, specially suitable for use in telegraphic apparatus." Creed & Co., Ltd., and F. G. Creed. October 21st, 1925. (260,758.)

27,072. "Illuminated advertising and display signs." C. A. Vandervell and Co., Ltd., and L. F. Bennett. October 28th, 1925. (260,767.)

28,444. "Speed control of electric motors." Siemens Bros. & Co., Ltd., and W. E. Goodwin. November 11th, 1925. (260,778.)

29,322. "Tilting headlamps for use on motor vehicles." Triumph Cycle Co., Ltd., and F. G. Parnell. November 20th, 1925. (260,784.)

29,670. "Multi-core electric cable." C. J. Beaver and W. T. Glover and Co., Ltd. November 24th, 1925. (260,786.)

30,333. "Electrical water-heaters." E. C. Steere. December 16th, 1924. (244,743.)

30,709. "Electrical resistances." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). December 4th, 1925. (260,793.)

32,555. "Devices for detachably fastening electric wires, cables, pipes, and the like on walls and other places." I. Kiss. December 31st, 1924. (245,442.)

1926.

632. "Duplex system for telegraph cables with loading coils." Dr. K. W. Wagner. January 17th, 1925. (246,135.)

1,004. "Apparatus for heating fluids by electricity." C. C. Pankratz. January 13th, 1925. (246,144.)

1,130. "Trucks for tramway and other vehicles." Brush Electrical Engineering Co., Ltd., and A. C. Baker. January 14th, 1926. (260,811.)

1,195. "Supporting devices for electric lamps, telephone receivers, optical and other instruments, and the like." W. H. King. January 15th, 1926. (260,812.)

1,794. "Wireless telegraphic picture transmission." Marconi's Wireless Telegraph Co., Ltd. January 22nd, 1925. (246,486.)

2,188. "Controllers for electric motor-driven devices." R. G. Lockett. January 25th, 1926. (260,816.)

3,144. "Switches for electric signalling devices." Soc. Anon. Saint-Didier. February 3rd, 1925. (247,195.)

6,037. "Insulated electric conductors." Liverpool Electric Cable Co., Ltd., and T. H. Tweedie. March 3rd, 1926. (Cognate application 13,458/26.) (260,837.)

6,225. "Sound reproducing apparatus." R. Brenchley. March 13th, 1925. (252,124.)

8,440. "Magneto-ignition machines." A. G. L. Neighbour. April 6th, 1925. (250,228.)

8,743. "Electric fuse-box with removable non-interchangeable fuse-carrying elements." Compagnie Générale d'Electricité. March 31st, 1925. (250,245.)

9,438. "Apparatus for rendering liquids radio active." J. G. Vaugeois. April 14th, 1925. (250,935.)

13,868. "Dry batteries." Soc. Anon. Le Carbone. July 17th, 1925. (Addition to 228,872.) (255,426.)

13,953. "Electric soldering irons." E. Cignolo. June 2nd, 1926. (260,887.)

17,455. "Apparatus for electrodeposition." International Copperclad Co. August 5th, 1924. (Divided application on 238,230.) (255,114.)

17,627. "Duplex radio telephone system." Wired Radio Inc. July 24th, 1925. (255,858.)

17,643. "Piezo electric devices." British Thomson-Houston Co., Ltd. July 14th, 1925. (255,463.)

18,131. "Gasfilled electric incandescent lamps." General Electric Co., Ltd. April 14th, 1926. (260,916.)

22,025. "Ignition-magnetos for internal-combusion engines." British Lighting and Ignition Co., Ltd., and J. C. Hutton. August 18th, 1925. (Divided application on 260,700.) (260,924.)

22,027. "Ignition-magnetos for internal-combustion engines." British Lighting and Ignition Co., Ltd., and J. C. Hutton. August 18th, 1925. (Divided application on 260,700.) (260,925.)

23,778. "Alternating-current motors." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). July 2nd, 1925. (Divided application on 259,285.) (260,929.)